PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

JULY 1956

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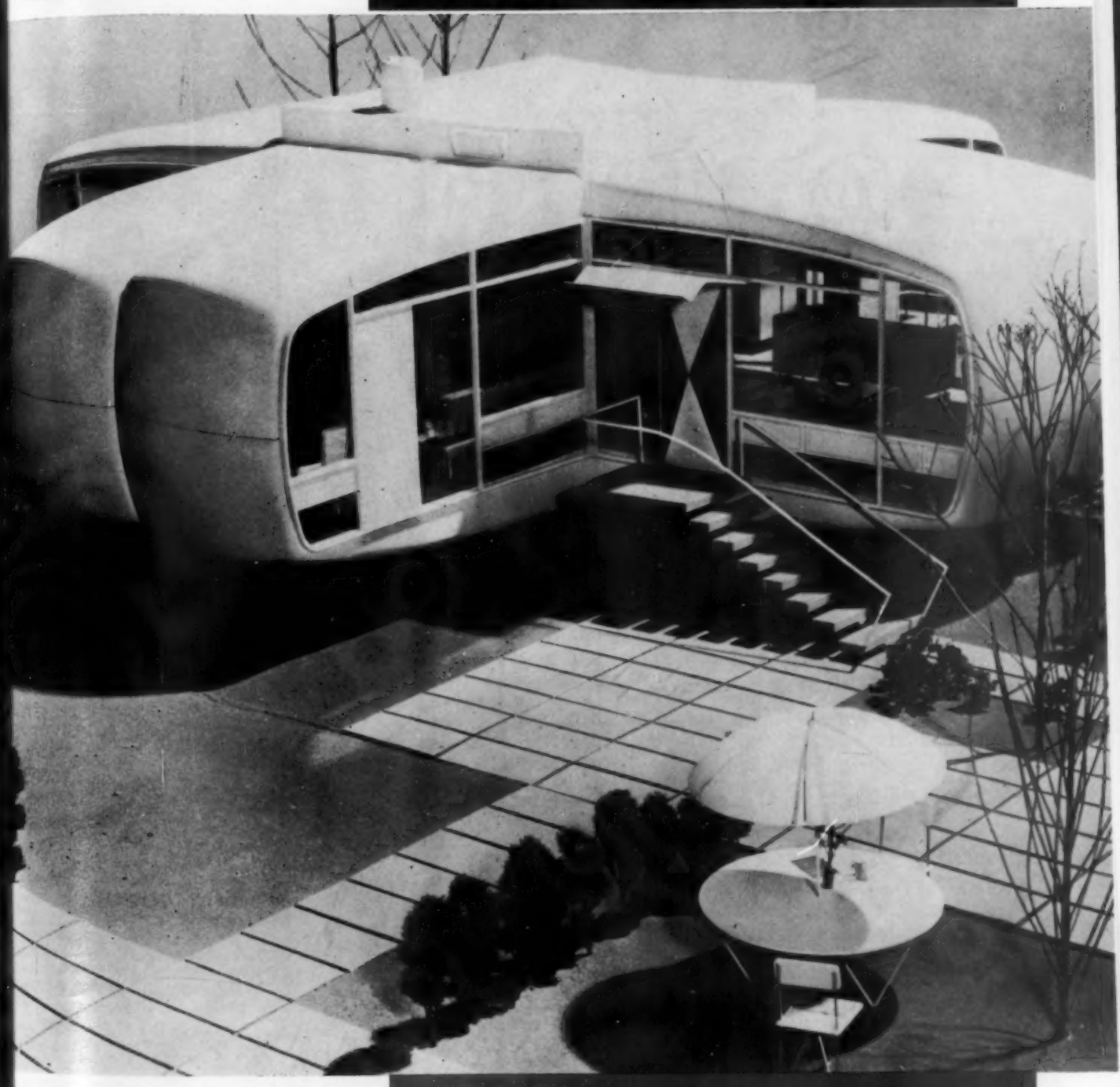

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See story on Plastics Exposition, page 468

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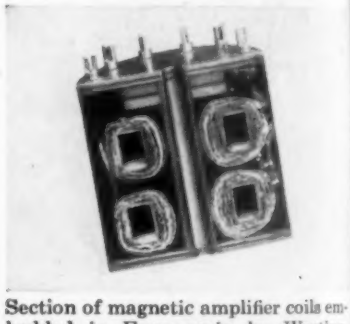

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Potting transformer with Epon resin at PCA Electronics, Inc., Santa Monica, California.

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Letters to the Editor

Complaints on Plastics Show

Dear Sir:

I attended the recent Plastics Exposition with great hopes and expectations. Some of these hopes were fulfilled, but many were not.

Firstly, why can't an exposition of this type be kept open at least one evening? This would serve a double purpose: (1) permit attendance by persons who cannot leave their work during the day; and (2) give the general public a chance to visit the show and find out what plastics can do.

Although the show was supposed to be restricted to the industry, there were many persons who obviously were either not in the industry or only remotely connected with plastics. This was evidenced by the many visitors carrying actual shopping bags crammed with all the give-aways they could obtain. Daytime registration should be more restrictive, and the public admitted only during one evening.

In general, the really interesting exhibits drew such crowds as to make them unapproachable. Some booths were so narrow and deep that only a few persons could enter at one time to see the equipment in operation. For such exhibits, booth lay-outs should stress increased length and decreased depth. This can be done by the exposition committee when laying out the exhibi space floor plan.

There is one more complaint on my list: Why do some companies go through the expense and effort of announcing that new items will be shown at the exposition, and then fail to show them? Reluctance to show new items before an audience of competitors is understandable, but why announce the item and then renege on the promise?

Of course, it is easy to sit back and criticize shortcomings. I did enjoy the show and feel that much credit should go to the exposition committee, the exhibitors, and, especially, the people who manned the crowded booths during the hectic week and had to endure the somewhat inadequate air conditioning, power overloads, and inadequate supply of process water.

William Lewi, Vice Pres.
Dusal Tool & Mold Co., Inc.
Long Island City, N. Y.

• • •

Repair of Extrusion Dies

Dear Sir:

For the past month, I have been searching for information on extrusion dies and have had no luck so far. Purdue University searched their files and came up with nothing, but referred me to your magazine.

I would like material on repair and maintenance of extrusion dies, particularly direct-type aluminum extrusion dies.

Fred V. LaBrie
Elkhart, Ind.

(To date we have not published any articles on repair or maintenance of extrusion dies. We have referred the inquirer to makers of extrusion dies, and are printing this letter to elicit further suggestions from our readers—Editor)

• • •

Who Makes "Viscoloid"?

Dear Sir:

I would appreciate any information you can offer regarding the identity of the manufacturer, or of a retailer, of a plastic material known as "Viscoloid."

This material is used as a vibration damping element in phonograph pickups, and has been on the market for over 15 years.

None of the local plastic suppliers has been able to offer any help.

Joseph J. Conradi
St. Louis, Mo.

(According to our files, Viscoloid is an obsolete trademark of Du Pont's for pyroxylin (nitrocellulose).—Editor)

• • •

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation, and address.

Letters requesting information on technical or engineering problems will be printed to elicit replies by the readers, either directly or through these columns. Upon request the identities of such "problem" letters will not be divulged.

—The Editor

"Quote . . . Unquote"

Society Controls vs. Achievement

"The question of the size of our business enterprises is frequently mentioned with concern. Of course, there is no doubt that the size of the industrial units essential to a strong economy has increased very substantially in the past 50 years and will increase even more substantially in the future.

"Modern society, leaning so heavily on technology, simply cannot exist without many large units. As our technological horizons broaden and increase in complexity, the demand will be for increasing rather than decreasing aggregations of talent, manpower, and resources.

"The pressures of society will inevitably produce their own controls and stabilizers. The segment of humanity concerned with business will be no less responsive to these pressures than any other group.

"This averaging process can have its bad side, of course, as well as its good. If the organization of modern society can hold a scoundrel in check, we run the risk that it can stifle the creative individual by submerging him into the common denominator.

"Just when we will realize the promise of the future and how far the new developments will take us depends on how well we are able to recognize and encourage individual achievement. We cannot move very rapidly if we shut the door on our ablest people by absorbing them in the lifeless tomb of mediocrity."

C. H. Greenewalt, President,
E. I. du Pont de Nemours & Co.,
Wilmington, Del.

• • •

Tube Caps of Polyethylene

"When we first had the opportunity to get acquainted with polyethylene in 1949, our industry (collapsible tube manufacturers) quickly saw its potential for collapsible tube closures. The elastomeric qualities of this excellent material and its tendency to shrink slightly, making it possible to produce a cap that would literally hug the neck of a tube. This banished forever the problem of caps loosened in transit, and also the resultant leakage of filled tubes when caps were so loosened. We did not wait for material manufacturers to urge this product on us, but our industry before 1950 had shown the initiative to invest over $100,000 in molds for the production of polyethylene caps. All of these caps are of ample weight and thickness to prevent product seepage. These caps are much too heavy to be permeable, and most of them are designed to withstand the heat of a waxing machine."

L. B. Platt, Exectuive Secretary,
Collapsible Tube Mfrs. Council,
New York, N. Y.

NEWS in BRIEF

New records in attendance and exhibit area were set at the Seventh National Plastics Exposition last month. Some 36,700 registrants attended the show, more than double the turn-out for the 1954 Exposition. Exhibits covered over 70,000 square feet of floor space, an increase of 25% over the preceding show. (Exposition story on page 469; see also editorial on page 441).

Continuous sealing of polyethylene film at rates of 500 feet per minute or higher is claimed possible by use of Bakelite's new molten bead sealing principle. A continuous bead of molten polyethylene resin is fed between layers of film moving at high speed to fuse the layers together. Film of almost any thickness can be sealed, and the method is said to be applicable to the sealing of polyethylene laminates and coated papers.

Lack of adequate quality controls on incoming molding and extrusion materials has hurt processors by causing losses in production time, direct labor, and overhead, as well as unpleasant customer relationships, says Carl F. Massopust, director of research and development for the plastics division of General American Transportation (see guest editorial, page 457). Experience at his company has proved that such controls can be accomplished, with the resultant savings for the processor and his customer.

Company developments in the news this month include Haveg Industries' creation of a new department for reinforced plastic marine products; the formation by Koppers of a new international company; Orangeburg Mfg.'s plans to enter the plastic pipe field; Phillips Chemical, preparing for full-scale marketing of its polyethylenes, has opened six new district offices; F. J. Stokes Machine Co.'s change of name to F. J. Stokes Corp.; and Wilmod's formation of a new rubber division to carry both rubber and plastics equipment.

Announcements of company expansions in plastics continue to come thick and fast. New facilities to more than double polyester resin capacity and nearly quadruple phenolic resin output will be built by Barrett Division at Toledo, O. Carlisle Chemical has greately expanded its research and general office facilities at Reading, O. Claremont Pigment Dispersion has opened a new plant in Roslyn Heights, N. Y. A new office and lab center is being built by Columbian Carbon in Monroe, La. Du Pont plans to virtually double productive capacity for polyethylene resins at its Orange,Tex., plant. General Electric will enlarge its silicone products plant at Waterford, N. Y. A new plant in West Warren, Mass., has been acquired by Haveg Industries. A new building has been added to Logo's plant in Chicago, Ill. Texas Eastman plans to broaden its work on high density, low pressure polyethylene plastics, and will build a semi-commercial works unit at Longview, Tex. Union Carbide plans two new polyethylene plants at Institute, W. Va., and Seadrift, Tex., with a combined rated annual capacity of 55-million pounds.

New Materials worthy of mention (see pages 477-8): elastomeric label adhesive; primary, low-tack plasticizer for vinyl; organic color pigment for plastics; rigid PVC extrusion compound; four styrene molding and extrusion compounds; and phthalocyanine green toner for plastics.

New Equipment to be noted (see pages 479-80): chrome plating unit; rotary-drum batch washer for small plastic parts; lab-type plastisol coating unit; bench-type vacuum and drape forming machine; and air-activated heat sealing machine.

New Products of interest (see pages 481-2): cellulose acetate lacquer; open-molding kit for making plastisol fishing lures; pearlescent acrylic plastic sheets; polyethylene medicine dropper with accurate droplet control; nylon tube fittings; molded polyethylene joint wrappings for field tile; vinyl film-lined swimming pool; vinyl anti-radiation suit; and fleixble nylon tubing for hydraulic, air, vacuum, fuel, or oil line use.

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PLASTICS TECHNOLOGY

JULY, 1956

EDITORIAL: Failings on Display at the Plastics Exposition

The recently-concluded Seventh National Plastics Exposition was a great success in reflecting the accomplishments and growth to date of the young plastics industry; its current status; and its optimistic outlook and potential for future growth. From the commercial viewpoint, too, the show was a success; exhibitors expressing satisfaction with the record attendance, and with the number of business inquiries and orders they received at the show.

From our viewpoint as a technical magazine devoted to furthering plastics as engineering materials, we must confess that the recent Exposition, while better than the past shows, still left something to be desired.

•

In its history, the Exposition has shown a definite trend toward displays of plastics applications that are of the engineered type, and away from displays of products that could only be classed as pretty, colorful novelties illustrating just the glamorous side of plastics.

We consider this trend to be highly desirable and necessary for the continued growth of the plastics industry and the eventual acceptance of plastics as true engineering materials used only in engineering applications.

An engineering application of plastics does not necessarily imply an industrial application, although such uses represent the major field of engineering application. Logically, a true engineering application utilizes a material whose properites meet the service requirements of the finished part. Accordingly, the product application may be used in the home, in commerce, in industry, etc.

This definition of an engineering application has a corollary: If, in addition to meeting the product's service requirements the plastic material used can offer an attractive color, finish, or other decorative effect, this plus feature is an *added benefit*. As such, this added benefit cannot serve as the sole justification for using plastics if the service requirements of the product are not met.

Of course, there are certain products whose service requirements are all but negligible, so that the decorative feature is the major reason for use of a plastic material. Such applications, however, are not major, large-volume uses for plastics and can be considered only as secondary applications for the plastics industry.

•

Obviously, this basic premise of using plastics only in engineered products would do away with the many misapplications of plastics, both past and present, that have contributed to their unsavory reputation, especially in consumer applications.

Such misapplications, in the sense of improper engineering and over-emphasis of secondary characteristics, were all too evident at the recent Exposition. Maturity of the plastics industry, unfortunately, is too slow in coming.

Arthur M. Merrill

Editor

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PLASTICS TECHNOLOGY

Designing with Vinyl Foam

A discussion of the properties of vinyl foam, their significance and utilization in application design.

R. WISOTZKY, *Development Director,*
L. E. Carpenter & Co., Inc., Wharton, N.J.

Traditionally, processors and users of vinyl film, sheeting, and coated fabrics are concerned with linear characteristics insofar as function and appearance are involved. Dealing with materials that are essentially sheet-like, conventional technical activity has been directed toward those properties of the sheet which are related to its position in a single plane. These are the properties of tensile strength, abrasion resistance, permeability, and related physical characteristics.

Design activity, as well, has been restricted mainly to changes in color of a surface or to relatively slight alterations in thickness of the surface. Most applications of these materials have involved the conventional function of a sheet; that is, the covering or protective characteristics typical of a relatively impermeable material whose thickness dimension is small.

Structural Design

While this is not meant to disparage some of the very handsome textural and color effects now available, the significance of the introduction of vinyl foam to the film and coated fabrics industry lies in the avail-

A native of Brockton, Mass., Reuben Wisotzky attended Harvard College, receiving a bachelor's degree in 1942. He served as chemist for Weymouth Art Leather Co. from 1945-50, and as manager of the coatings division for Philadelphia Textile Finishers from 1950-53. He joined Carpenter in 1953 as chief chemist, and was promoted recently to his present position as development director, responsible for new product and new process development. A member of SPI, he is active in the Society's Film, Sheeting and Coated Fabrics Division and the Cellular Plastics Division. Mr. Wisotzky resides in Morristown, N. J., with his wife and two children.

Henry Platts Studio

ability of a new degree of freedom for the designer and the engineer; i.e., the dimension of thickness. It is now possible to extend the uses and modify the appearance of our multicolored, surface-textured envelope so that the content of the envelope contributes to both the design and function of the structure. The designer and the application engineer now can operate much more freely in all three dimensions; in fact, they can work in the architectural sense since the form and structure of the product now are related. It is the concept of structure that is new, in a sense, to our thinking.

Previous attempts to introduce a structural and textural significance to laminated products have been only partially successful. For example, there are many products now in use involving an inert interlayer, such as a fibrous wadding, between two sheets of thermoplastic material. This laminated product is generally die-embossed. Heat sealing a pattern which permits a relatively large amount of unsealed area to retain its original thickness introduces a rather successful quilted effect. Due to the non-resilient character of the filler material, however, there are limitations to its application over simple or compound curved surfaces. Consequently, while this composite system is quite successful from a decorative point of view, it does not make any significant structural contributions.

The term "structure" used herein is a key to the unique contribution vinyl foam will make. It is used with reference to those characteristics which describe a load-bearing function. In its normal application, foam rubber has been used as a structural material where its ability to sustain a load without permanent change of shape together with a relatively low weight per unit volume can be used to best advantage. We are indebted to the foam rubber industry for nomenclature and for many of the testing and specification attitudes developed over the past decade of successful foam rubber application.

Vinyl Foam Processes

To treat foam vinyl and this idea of structure in design with confidence, the film and coated fabrics industry would do well to become familiar with some of the processes used to make vinyl foam. Chemical blowing fundamentally involves the decomposition of a blowing agent with the evolution of an inert gas, such as carbon dioxide or nitrogen, at temperatures near or below the fusing point of the vinyl plastisol.

Another basic process for the manufacture of vinyl foam was developed and patented in 1949 by Elastomer Chemical Co. It is this manufacturing method which has contributed to the widespread interest in commercial vinyl foam. There are now 25 domestic licenses in various stages of development and/or production, and nine in Canada and Europe.

This latter process is referred to as mechanical blowing. In essence, it depends on the carbonation of a specially formulated vinyl plastisol under specific conditions. The carbonated, wet foamed product can be discharged onto a conveyor belt, and then fused in a dielectric field of appropriate frequency and voltage to an expanded, resilient, flexible mass of slab or sheet stock. The same general principles of carbonation, formulation, and handling of the carbonated plastisol can be used in filling molds and fusing the molded products. In the case of molded vinyl foam, hot air-oven fusion may be used to gel and fuse the molded cellular article.

In general, references to vinyl foam in this paper are to slab stock made by the Elastomer process. This form of vinyl foam has been available in increasing quantity and improving quality for the past three to six months from at least four reliable manufacturers. While described here in its simplest terms, the process is actually quite complex, and must be rigorously controlled to maintain uniformity of thickness, cell size and distribution, and fusion. The relatively intuitive methods of formulation and equipment design which have made plastisol formulation and application a blend of empirical science and cookbook art do not apply to the rigorous and disciplined skill involved in making good, uniform foam. The improved quality of vinyl foam over the past few months reflects an increasing awareness of the significance of technique.

Availability of Foam

The foam widths now being offered range from 24-36 inches. The basic equipment for the manufacture of slab stock is generally designed to handle at least up to the 54-inch width conventional in the textile and film and sheeting industries. Slabs are manufactured, for reasons of operating economy, in an average thickness of 2-3 inches. These, of course, can then be split with available commercial equipment to at least ⅛-inch in thickness. It is hoped that 1/16-inch vinyl foam will become available as the art of splitting is further refined. Foam can, of course, be cast directly onto a web, either textile or paper, and fused in place. There is no fundamental restriction with regard to length of piece, but the very high volume to weight ratio makes it impractical to consider convenient handling and transport of two-inch slabs longer than 20 feet.

Foam Properties

These simple physical dimensions determine the effective volume of a vinyl foam slab, and it is on the basis of volume that the slab is marketed. The normal unit of sale is a square foot of a given thickness. To the manufacturer, then, the density or the pounds per cubic foot of his product is a highly significant factor in the calculation of his selling price. The fabricator, on the other hand, is concerned with the number of units of volume that he is buying, and the density is secondary inasmuch as it contributes only to the weight of his finished product.

Density vs. Load-Bearing

The fabricator is buying vinyl foam in terms of its load-carrying characteristics or in terms of its thickness. It is important that the user of vinyl foam understand that the relationship between density and load-bearing characteristic, which is so important in understanding the properties of foam rubber, do not necessarily apply in the case of foam vinyl. The load-carrying properties of foam vinyl are related as much to the

amount and type of plasticizer as to the product density.

This principle is extremely significant and should be restated. Foam vinyl weighing six pounds per cubic foot can be formulated to carry as much load as foam vinyl weighing nine pounds per cubic foot. On the other hand, foam rubber of six pounds per cubic foot density normally supports only half the load that foam rubber of nine pounds per cubic foot density would support.

Not only is there available a wide range of the usual physical properties as we regard these in the film and coated fabrics industry, but a change in plasticizer type and amount also changes the structural characteristics of the foam product. It is timely, then, to consider some of these structural characteristics and how they can be used to describe the experiences we have had when we manipulate a solid piece of foam.

The load-carrying characteristics of foam products are conventionally described in terms of hardness. This is normally a single-point measurement frequently referred to as indentation, or compression deflection, or load deflection. It is a simple representation of a stress-strain characteristic, and is expressed in terms of the number of pounds required to compress a standard sample by 25% when this force is applied over a 50-square inch area.

The Rubber Manufacturers' Association has conveniently tabulated a series of load deflection values in varying descriptive terms of hardness. For example, if 5-10 pounds are required to compress a 12 x 12-inch slab by 25%, the slab is called extra soft; and if 25-40 pounds are required, it is called medium soft. Dealing with foam rubber, the expression "soft" has the connotation of a stress-strain relationship and, in addition, the further implication of a density range since density and hardness are quite directly related. In the case of foam vinyl, as previously noted, this is not necessarily the situation.

Stress-Strain Properties

There are further significant structural differences between foam vinyl and other foam types. The stress-strain curve of foam rubber is essentially linear with increasing load, but this is not necessarily the case with foam vinyl. As previously noted, the dynamic stress-strain characteristics of foam vinyl depend largely on formulation and can be varied. An accurate picture of the stress-strain characteristics of foam vinyl is not necessarily reflected in a single-point hardness description. Recent work indicates that a more detailed study of the stress-strain curves of foam vinyl under compression is needed. Until this matter has been clarified, it is important to recognize these basic differences between the two materials when they are described by the same conventional test. Equivalent single-point indentation readings, as prescribed by the Rubber Manufacturers' Association, may not necessarily provide the fabricator or user with the same structural characteristics.

Compression Set

The RMA guide* gives a test for compression set under constant deflection at elevated temperatures, can be used to screen materials intended for continuous service at high temperatures. The test requires that a sample shall not lose more than 10% of its original thickness after being compressed to 50% of its original height for 22 hours at 158° F. Thirty-minute recovery at room temperature is allowed before measuring the loss in thickness.

This test does illuminate the fundamental difference in behavior of foam vinyl and some other cellular products. While foam rubber samples, if properly vulcanized, rarely exceed 5% and generally average 1-3% loss in thickness, foam vinyl materials currently available probably show an average loss of 15% if tested as specified by the RMA. The reason for this, of course, is in the nature of the beast; vinyl is sensitive to heat and can be permanently deformed at elevated temperatures. The foam vinyls now on the market show very little if any permanent set at temperatures up to 120° F. It is interesting to note that foam vinyl having a permanent set due to elevated temperature exposure will recover almost completely if held at the best temperature.

Flexing

The flexing test in the RMA specification is concerned with the amount of permanent set that is developed after 250,000 cycles at the rate of 60 cycles per minute with the samples being compressed to 50% of their original thickness in each cycle. When properly fused, vinyl foam meets this test with no difficulty. This test does perform the useful function of rejecting vinyl foam material which is not thoroughly fused.

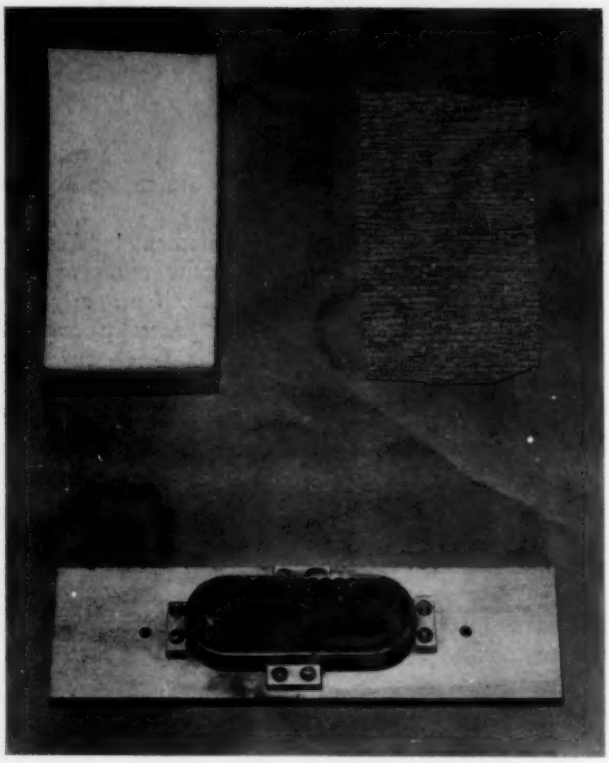
Fusion

A vinyl plastisol is essentially a discontinuous system until fused, and its ultimate properties depend upon the complete internal coalescence of the dispersed resin particles and the plasticizer. It is possible, of course, to partially fuse a sample so that the resin appears to have attained complete solution in the plasticizer and the film appears to be continuous. If sufficient energy has not been put into the system to completely accomplish this fusion, however, the product will have a very serious latent defect.

Under-fused foam will show poor compression set, but indentation or single-point compression deflection determination appears normal. In addition, under-fused vinyl foam has much poorer tensile strength, very poor resistance to certain solvents, and (of most significance to the fabricator) inability to be heat sealed.

The thermoplastic character of foam vinyl makes it ideally suitable for radio-frequency dielectric heat sealing and die embossing (see Figures 1 and 2). Compared with other cellular products, foam vinyl is outstanding in this characteristic. Heat sealing industry requires uniformity of density, cell structure, and fusion. Over-fused material can be troublesome, too, since it is almost always associated with increase in density or partial cell collapse. A higher-density foam changes the RF power requirements of machines set for production-line speeds based on uniform density. Poor seals are the consequence of such variation.

* "Latex Foam," Buyers' Specification, Rubber Manufacturers Association, Inc., New York, N. Y. (Revised April 1, 1953).



(Courtesy—Elastomer Chemical Corp.)

Fig. 1. Vinyl foam, vinyl film, and die used in heat-sealing the film to the foam by the tear-seal die method.

This latent defect of under-fusion is an extremely serious one and can easily be the cause for poor public relations in the early stages of vinyl foam development work. The vinyl-coated fabrics market had a similar poor experience in its earlier days when films that appeared to be fully developed, continuous system peeled, cracked, and flaked in an abnormally short time when put into service. In most cases, this was a reflection of poor fusion.

Low-Temperature Properties

While there is no reference in the RMA Guide to low-temperature properties of foam rubber, frequent allusions have been made to the alleged poor characteristics of vinyl foam. In general, the same principles that apply for the improvement of the low-temperature properties of vinyl film are involved in formulating vinyl foam.

(Courtesy—Elastomer Chemical Corp.)

Fig. 2. Heat-sealed vinyl foam-film item made with the tear-seal die shown in Fig. 1.

It is interesting to note that even those formulations which would not normally be expected to show good low temperature performance in a film do not impair the usefulness of vinyl foam to the point where it shatters on impact. Some of the better low-temperature formulations used in foam vinyl increase the compression deflection by 300-400% at –30° F. In simple terms, this means that a material having an indentation value of 10 pounds per 50 square inches at room temperature requires 40 pounds per 50 square inches at –30° F. Stated another way, a soft piece of flexible foam becomes a firm piece of flexible foam under the RMA classification when it is exposed to a temperature of –30° F.

Densities normally available at present are in the 6-7 pound per cubic foot range, with the density dropping as production know-how improves. Developmental samples have been made at densities of 3-4 pounds per cubic foot, and it should not be too long before these become available commercially. The chemical resistance, excellent aging, and performance characteristics of vinyl materials are not unknown, and these same desirable properties are just as readily associated with vinyl foam formulations.

Insulating Qualities

In addition to the structural aspects of foam vinyl detailed above, there are other unique properties of cellular products which should not be neglected. These are the insulating properties for both heat and sound. The K-factor for vinyl foam has been reported as being approximately 0.25 BTU/hour/square foot/°F./square inch. This value is of interest when compared with the corresponding K-factor of approximately 0.30 for cork. Cork has a density of approximately nine pounds per cubic foot, and vinyl foam a density of approximately seven pounds per cubic foot.

The sound-absorbent coefficient for foam vinyl at 512 cycles per second has been reported as being approximately 0.30. These insulating characteristics require further study, of course, and it may very well be shown that variations in cell sizes or distributions will offer some latitude in the improvement of both these insulation values.

Compatibility

Compatibility, as it is known in the vinyl foam and coated fabrics industry, has always been a problem. For our present purpose, however, this matter of compatibility may well help us instead of being a handicap. It has been difficult in the past to use non-vinyl cellular products in combination with vinyl film or coated fabric because of the inherent staining problems of plasticizer migration. This is certainly not the case when vinyl film or coated fabric is used in conjunction with vinyl foam.

With the exercise of very simple precautions, we can truly marry the components in a fabricated product and be assured of their compatibility. The possibility of chemical cross-staining exists, of course, but is not as

serious or hazardous as the anti-oxidant or lead sulfide staining so familiar to us.

There is, of course, the possibility of plasticizer migration in the direction of a copolymer resin or of a lower molecular-weight resin. These are effects, however, with which most experienced formulators are familiar, and which can be overcome with no fundamental changes in any of the characteristics of either the vinyl film or the vinyl foam. It must be emphasized that all other problems are not eliminated simply because we are joining vinyl to vinyl. Good formulating practice must still be followed.

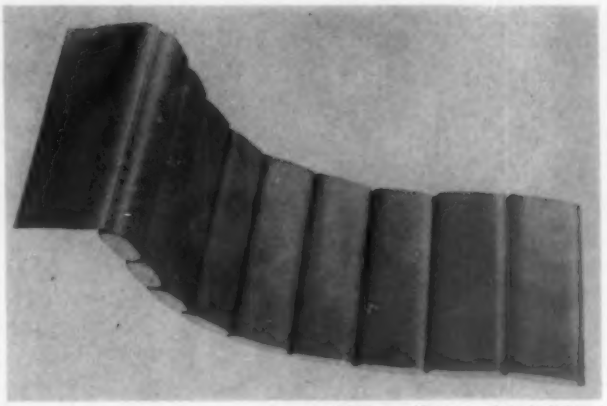
Design Applications

Application methods for the use of vinyl foam involve the traditional techniques for thermoplastic materials. Product designs, which usually represent a composite of vinyl film, sheeting, or coated fabric together with the vinyl foam, can be shaped and joined under heat and pressure virtually at will. The inherent toughness, abrasion resistance, high tensile strength, specific chemical resistance, good aging characteristics of vinyl film are carried through in the union of the film with vinyl foam in a composite structure. One part does not degrade the other, as might be the case with an inert filler or an incompatible cellular elastomer. The foam vinyl makes a positive contribution to the product by contributing to the absorption of energy, will still maintain the excellent aging characteristics, fire resistance, mildew resistance, and other familiar, desirable characteristics shown by plasticized vinyl products.

The ease with which vinyl foam in combination with vinyl film and coated fabrics can be made resistant to fire suggests its early consideration in institutional seating and other load-bearing functions where these conditions are important. The aircraft companies and the public transportation people have shown real interest in vinyl foam, in both slab and molded foam, for seating applications. Here, too, the sound-absorption characteristics could easily be designed into wall-covering and floor-covering materials if suitably laminated and imaginatively embossed.

The fabricator should make every effort to understand the engineering limitations inherent in the new product so as not to exceed the performance limits of this material. Although it is true that vinyl foam can be modified virtually at will, vinyl foam developed to resist soapy water extraction for undergarment use may well be unsuitable as a crash pad material because the energy absorption characteristics are not developed to their maximum. It may also very well be true that a foam vinyl developed for good low temperature structural characteristics in automotive seating may not be a good rug underlay material where lack of migration resistance or compatibility with wood finishes is critically significant.

There is no real practical limit to the depth of contour available to the designer with a flair for dramatic surface interest. Very deeply scored lines and confiurations can be permanently embossed by taking advantage of the thermoplastic character of vinyl foam (see Figure 3). The application of heat and pressure locally on a specific line will collapse all of the vinyl cells in the foam directly beneath the point of pressure. When the vinyl cools and the force is removed, a crowned, smoothly rounded surface results which is under persistent pressure from below and, hence, maintains its shape no matter the type of a curved surface over which the foam is then pulled, bent, or folded. This type of application is particularly useful in the design of automotive sidewalk, bolsters, and seating. It has appeared already in very handsome three-dimensional quilted effects in handbags, belts, and novelties (see Figure 4).



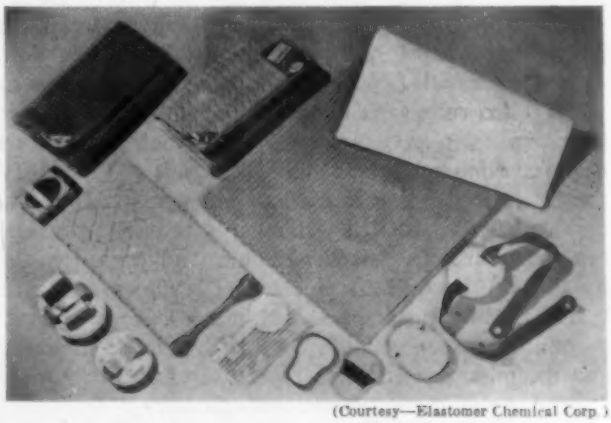
(Courtesy—Elastomer Chemical Corp.)

Fig. 3. Deeply quilted effect obtained by heat sealing or die embossing vinyl film to vinyl foam.

Vinyl foam can be colored as easily and in as wide a range as vinyl film and coated fabric. Objects such as bathmats and slippers can be fabricated from foam without the benefit of further reinforcement or decoration. In combinations with other materials such as cloth, vinyl-coated fabric, or vinyl film, the foam can be attached by adhesives, cast directly on the web, or laminated by heat sealing. This composite product is suitable for flat cushioning, rug underlay, automotive sidewall, etc.

Applications for vinyl foam will continue to increase in number and variety as the imagination and ingenuity of designers and engineers are stimulated by the unique properties of this new product. Soundly engineered laminates will contribute significant functional characteristics to striking decorative effects as vinyl foam finds new and economically significant applications.

—THE END



(Courtesy—Elastomer Chemical Corp.)

Fig. 4. Handsome three-dimensional quilted effects obtained by heat sealing vinyl film to vinyl foam.

Calendering Equipment for Plastics*

Calender developments emphasize improved control of calender roll temperatures and stock thickness.

R. C. SEANOR, *Vice President in Charge of Engineering*
Adamson United Co., Akron, Ohio

Since the late 1930's, there has been a vast growth in the calendering of vinyl plastic film. When the plastic film industry began to expand about 16-18 years ago, the only available equipment was that which had been designed for calendering rubber and its compounds. For a long time, there had been little change in the design of calenders. These early calenders were built for speeds of 20-30 per minute and, at the time they were installed, probably no thought was given to whether the rolls were concentric or not.

It was soon recognized, however, that in order to calender thinner gages of plastic materials and to satisfy the dimensional requirements of the trade, it was necessary to have a unit that was much more accurate than the average rubber calender of that day. A modern 28 by 78-inch, four-roll Z-type calender is shown in Figure 1. The rolls had to be made with much less eccentricity, more accurate temperature controls had to be supplied, and the middle roll had to be stabilized in its journals during operation.

Furthermore, the average manufacturer of calendered vinyl film had to make a large variety of colors and gages to meet the demands of the trade. In changing from four to 12-mil film, there is a great change in the separating forces in the calender. This presented the problem of trying to produce flat stock in all gages with the crowns ground on the calender roll; consequently, for only a narrow range of gages was the manufacturer producing a really flat stock.

In the attempt to solve these problems, the machinery builders have introduced various devices which looked promising and some have turned out to be quite beneficial. It is these devices or design changes which make the modern calender what it is today.

Temperature Control

One of the first problems, of course, was that of temperature control. In many old rubber shop installations, the operator turned on a little steam or water as he felt it was necessary. In calendering plastic film, the required temperatures are usually in the range of

* Based on a paper presented at the twelfth annual National Technical Conference, Society of Plastics Engineers, Inc., Cleveland, O., Jan. 19, 1956.

310-350° F. and because the narrow temperature band in which the material could be processed, this hand method soon proved inadequate. However, we have seen calender temperatures controlled by hand while calendering plastic film. On the other hand, the advantages of automatic temperature control were obviously so great that most calender manufacturers put one type or another of automatic control on their units. The big problem of automatic temperature control, of course, is that of sensing the temperature of the outer surface of the roll during operation.

Even the best temperature controls still left much to be desired, however, and the next step was the introduction of the drilled roll. With the drilled roll, it was possible to increase the width of good film taken from the calender because the temperatures at the ends of the roll faces were not affected, as in the case of the bored roll, by the large mass of metal at each end of the bored chamber. Figure 2 shows a sketch of a drilled roll in which the circulation path is indicated. With this improved temperature control, it was possible to step up the speed of calendering.

We do not mean, however, that they could not have calendered faster in the earlier days. With the drilled type of roll, any required temperature change can be obtained so much more quickly at the surface of the roll that the operators can produce at a higher rate of speed without as much scrap as occurs with the chamber-bored rolls. With the use of steam heat, the higher speeds brought up the possibility of trapped condensate in the drilled holes. This has been solved by the circulation of high-pressure hot water through the drilled rolls.

It should be pointed out that the surface temperature of the drilled roll can be changed not only more rapidly than that of the bored roll, but also with less thermal shock to the roll. As the temperatures at which plastic materials are calendered rises higher and higher, the pressure for the hot water system becomes greater. At these higher temperatures, however, there are other fluids, such as molten salts, or other patented heating media which can be used without requiring a high-pressure piping system.

Stock Gage Control

Another problem was that of producing stock of constant gage. For this purpose, the roll must be round, but the task of manufacturing a round roll presents some difficulties. To produce a roll that is round within 0.001 inch presents no problems, and to make it round within 0.0005 inch is not much more difficult. Even this, however, is not good enough for plastic film. It has been found that film can be produced within commercial tolerances if the gaging rolls of the calender have eccentricity readings of 0.0003 inch or less. To produce rolls with these fine eccentricities (and we have produced them with eccentricities as low as 0.0001 inch) is strictly a shop problem and a matter of care in final grinding of the roll.

Zero Clearance

Two solutions have been offered to the problem of stabilizing the roll in its journal during operation. The most widely used method is that of the so-called zero clearance. This consists of an auxiliary bearing on a roll neck loaded either by springs or hydraulic means. The load on this auxiliary bearing is designed to hold the roll as closely as possible to the position in which it normally tends to operate. Figure 3 shows a 32 by 92-inch, four-roll calender with zero clearance on the top roll.

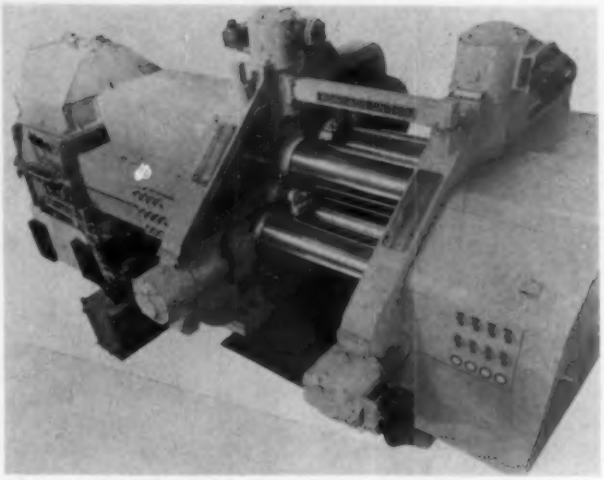


Fig. 1. Modern 28 x 78-in. Z-type calender.

This zero-clearance feature was originally designed to stabilize the center roll of the calender. Early, it was found that when the loads on both sides of the center roll became somewhat close to being in balance, the center roll would move about in its journal clearance and produce film having a constantly varying gage. The original zero clearance was designed to produce a definite unbalance on the center roll so that it would always stay in one position (usually arranged to bring the center roll down against the bottom of its bushing). This zero-clearance device has since been extended to the other rolls of the calender, and some believe it will always keep the rolls from coming together when stock is run out of the calender.

Looking at an off-set roll, we find that the normal position of the journal center will be under the screw and slightly above the center-line. If we pull in this direction with the zero-clearance arrangement, it will be of considerable help in keeping the roll from moving its journal during small load changes that might occur in the machine operation. Since the pull is almost horizontal in this case when the stock runs out from the calender, it will take terrific force to keep this roll from falling at least part of the way in its journal clearance. Furthermore, this zero-clearance equipment

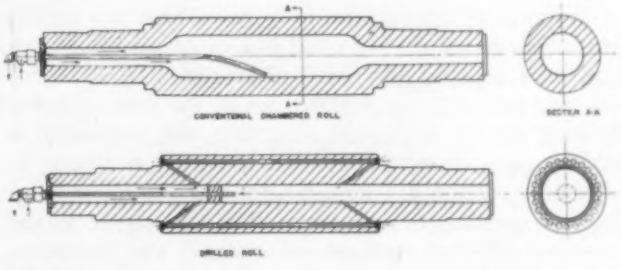


Fig. 2. Cross-sectional drawings of chambered and drilled calender rolls.

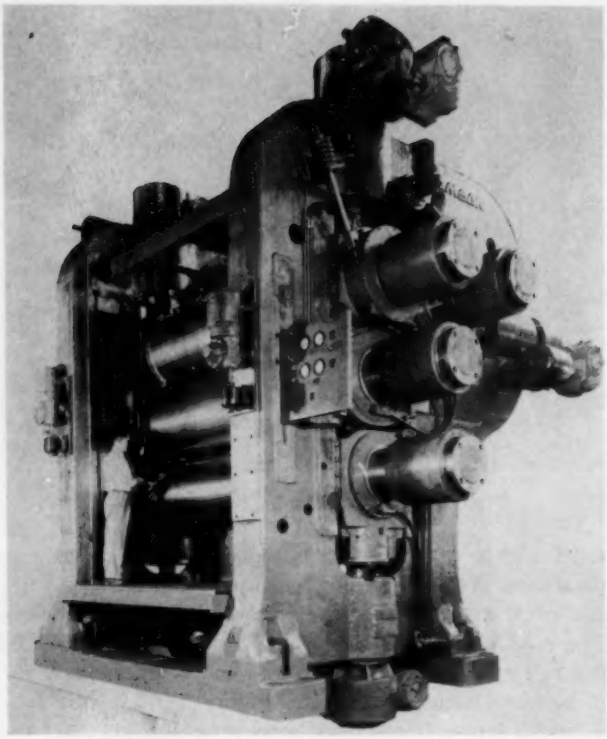


Fig. 3. 32 x 92-in. four-roll calender with zero clearance on top roll for shock gage control.

cannot keep the roll from moving in its journal position during operation, since it is only one of the forces imposed on the journal.

The actual position of the roll is dependent on the resultant of all these loads on the roll, the amount of journal clearance, and speed. Consequently, despite the zero clearance, the center of the roll will shift when any one of these loads are changed. These factors are noted not to criticize zero clearance, but to point out that it is not perfect and a cure-all for calender ills.

Roller Bearings

Another method of stabilizing the rolls in their bearings during operation is by the use of roller bearings. Figure 4 shows the roller bearing without the outer races as mounted on a roll neck for a 28 by 70-inch plastic film calender. There are two types of bearings made which will carry the loads of the calender; namely, the tapered roller bearing, and the spherical roller bearing. While both bearings are equally good, the physical construction of the tapered roller bearing is such that it is relatively easy to change the internal clearance of the bearing for different roll operating temperatures.

With roller bearings, we have found that best results are obtained by grinding the roll in its own bearings. This can be done only if all clearance is taken out of the bearing while cold. Here, again, the tapered roller bearing has the advantage, since it is only necessary to change the shims behind the bearing retainers to eliminate clearance. The limitations of the roller bearing are speed and temperature. The speed reduces the capacity of the bearing to carry load, and the bearing temperature must be at a level that will not decrease the hardness of the races and rollers. At current operating temperatures, we have had no difficulty in keeping the bearings sufficiently cool and have learned from experience how to set the bearings so that they will give good service life.

We might point out that roller bearings have been used on European mills and calenders for a long time. A bulletin issued by S.K.F. in 1943 lists 187 mills and calenders which had been equipped with S.K.F. roller bearings. At Adamson, we have equipped more than 20 calenders with roller bearings in the past 10 years.

The roller bearing can not only be set up to operate with zero journal clearance, but there is no wear of the bearing during its life as there is with the journal bearing. In addition, internal clearances are just as small up to the point of failure as they were when the bearing was new. This can probably also be said for a well-lubricated journal bearing, but at calendering speeds, the journal bearing cannot always be sure of perfect film oil lubrication. Were it not for this, a well-designed journal bearing would lose only a few thousandths of an inch of metal in several years of operation.

Roll Crowning

In addition to the gage variation caused by roll run-out and movement of the rolls in their journals, there is also the problem of gage variation introduced by deflection of the roll. To overcome this, the calender rolls normally are crowned so that (when the calender is loaded), the roll surface under load in the nips will be flat and parallel, thus producing a flat sheet. Obviously, such an arrangement will produce a flat sheet for only one calender load. If either the gage or the compound is changed sufficiently to alter the calender load, the sheet will no longer be flat.

Many methods of overcoming this shortcoming have been tried, such as obtaining slightly thinner gages by stretching the material as it comes from the calender, by varying the sizes of the stock banks at the various nips to produce the desired results, and by the application of external heat in the form of induction heating or infra-red light. If none of these methods can produce the desired effect, it is then necessary to regrind the rolls in order to produce a flat sheet.

In order to recrown rolls without removing them from the calender, the art of roll honing has become quite important. With roll honing, it is not necessary to take the roll out of the calender for grinding nearly

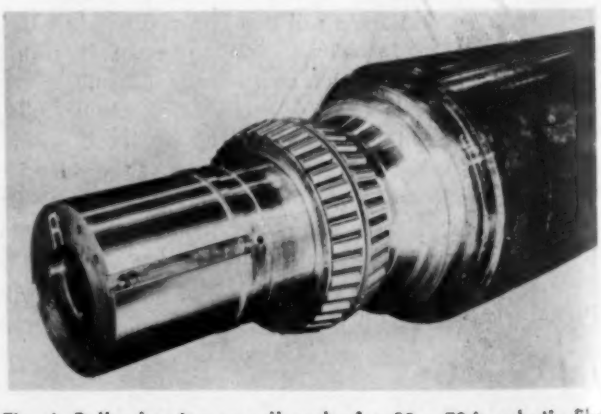


Fig. 4. Roller bearing on roll neck of a 28 x 70-in. plastic film calender roll.

so often as was previously the case.

Roll Crossing

The next step in compensating for this crown is roll crossing. In this instance, one roll has its axis crossed with respect to the axis of the adjacent roll. This crossing of axes changes the gap between the rolls along the length of the roll. This crossing of axes changes the gap between the rolls along the length of the bite in the manner similar to that obtained by regrinding the roll to obtain a different crown. Figure 5 shows a sketch in which one roll has its axis crossed with respect to the adjacent roll. With this roll crossing in the range now used on calenders, the crown simulated by the roll crossing varies from the theoretical deflection curve in only about the fifth decimal place.

Figure 6 is the deflection curve figured out for a 24 by 68 inch roll. In the lower left side of this figure is a tabulation of the crown at various distances from the center roll, as calculated from the theoretical deflection curve and as calculated for roll crossing. The amount of crown compensation that can be obtained by roll crossing depends on the individual calender and the amount of roll movement that can be afforded within the calender frames. In designing a new calender, however, it is not difficult to obtain a 0.010-0.012 inch crown variation by roll crossing.

Roll Bending

In addition to roll crossing, there is also the use of roll bending to provide crown compensation. With this method, the roll neck is loaded through an auxiliary bearing so as to produce a bending moment throughout the length of the roll that will result in a deflection of the roll. A calender with roll bending is shown in Figure 7. Underneath the bottom roll box of this calender is a connection leading to a high-pressure hydraulic cylinder which supplies the roll-bending load.

In actual experiments with roll bending, we have brought about a change in gage across the width of the calendered sheet of as much as 0.002 inch from the center to the edge. Our calculations indicate that we can go even further than this; recently, we have made some installations from which additional data are expected. With roll bending, however, we cannot cover quite the range of crown compensation which can be accomplished by roll crossing. However, the sensitivity of the roll bender to fine adjustment is the same throughout its range; whereas once the roll boxes on the roll have been moved about ⅜ inch off center, the amount of roll crown compensation for a given movement of the box increases rapidly, thereby lowering the sensitivity of adjustment.

The roll bender can be put on a calender with the gearing hung on calender roll necks, whereas a proper installation of roll crossing requires the use of a pinion stand. Furthermore, it is possible to add this roll bender to a great many old calenders, although each installation requires its own investigation to determine if it is feasible. On the other hand, roll crossing can be applied to old calenders only by supplying new calender housings and a pinion stand. After putting the roll bender on the bottom roll of an old calender, one

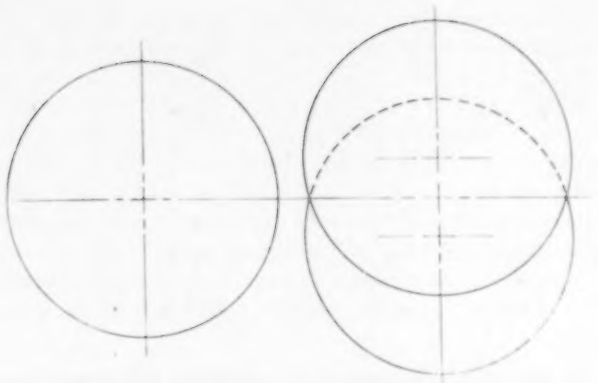


Fig. 5. Sketch of calender roll ends showing crossing of roll axes.

of our customers added it to the top roll and successfully increased the range of gages which can be run on this calender with one given roll crown.

Types of Calenders

In general, plastic film has been calendered on three types of calenders: the standard three-roll calender, with all three rolls in one vertical stack; the inverted-L calender; and the Z-type calender (the last two being four-roll machines). The four-roll calender appears to be preferred over the three-roll machine by plastic film manufacturers. Figure 7 shows an inverted-L calender, while Figure 1 shows a Z-type unit; both are four-roll machines. The four-roll machine gives three working

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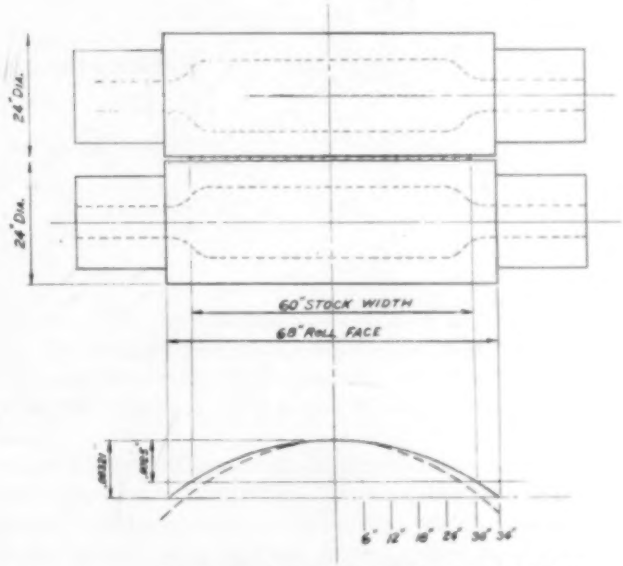


Dotted Line Indicates Change In Contour If The Ends Of The Roll Face Are 14°F. Cooler Than Center Section.

Distance From ℄ Roll Face	Load Deflection	Standard Crown	+/- 0.001" Crossed Axis Crown
0	0	0	0
6"	.000110	.000100	.000100
12"	.000432	.000400	.000400
18"	.000955	.000850	.000876
24"	.001656	.001600	.001600
30"	.002500	.002500	.002500
34"		.003211	.003211

Fig. 6. Deflection curve (center) obtained by roll crossing for a 24 x 68-inch roll. At bottom is a tabulation of roll crown at various distances from the center roll, as calculated from the theoretical deflection curve and from roll crossing.

G. R. Franson, *Plastics Development Engineer, Dow Chemical Co., Midland, Mich.*

Fabrication Methods for Expandable Polystyrene*

A description of properties, fabrication, and applications with emphasis on foaming and molding operations.

The field of plastics is a comparatively new one, and each year new and startling materials have entered the market. One of the more significant plastic raw materials to reach the market in recent years is expandable polystyrene.

There is a decided difference between expanded and expandable polystyrene. "Expanded" connotates past tense or already expanded, while "expandable" means that the expanding action can take place in the future. The fact that the processor can expand the material is possibly the reason why expandable polystyrene has captured the market with many interesting and varied applications in the short time it has been available. This material has been on the American market less than two years, but many new uses have already been created for it.

The material is furnished in the form of small, round, free-flowing beads. These beads may vary in diameter from 1/32-1/4 inch, since different size beads are more advantageous for different end-uses. The beads themselves are composed of a polystyrene base polymer containing a dissolved gaseous expanding agent. When the beads are heated in a closed mold, the polystyrene softens and the expanding agent causes the beads to expand, producing a homogeneous foam. The gas remains inside each of the cells formed, producing a foam with a non-interconnecting cellular structure.

Fabrication Methods

The fabrication methods which can be used to expand the material in closed molds are quite simple. It has been found, however, that a preliminary step is necessary in most moldings before final expansion. In this prefoaming or pre-expansion step, the beads are partially foamed or partially expanded to about 25-50% of their final volume outside of the mold. Figure 1 shows the beads as supplied (left), and the same beads after pre-expansion to 50% of their final volume (right). By prefoaming the beads, the mold can be filled before the final heat is applied. This results in a more uniform expansion of the beads, and eliminates voids

* Based on a paper presented at the twelfth annual National Technical Conference, Society of Plastics Engineers, Inc., Cleveland, O., Jan. 19, 1956.

in the foam. It has also been found that this step is necessary to make low-density moldings.

Prefoaming

There are several methods for accomplishing this prefoaming, one being the conveyor belt-radiant heat method shown in Figure 2. In this method, the unfoamed beads are loaded in the hopper and moved onto the belt by a vibrating feeder. The beads are metered onto the belt in a single layer, so that all beads may be heated uniformly. As the beads pass under the heater, they are expanded to a predetermined density. The degree of pre-expansion is controlled by the intensity of the heat source, distance from the belt to the heater, and the rate at which the belt is moving. With these controls, the size of the prefoamed bead can be varied to give a controlled bulk density about 1½-10 pounds per cubic foot. The beads are then cooled on the cooling section by exposure to normal room air. The beads form into a series of clusters which, after cooling, are easily broken up by the rolls at the end of the conveyor. After being broken up, they again become free-flowing beads and are ready to be charged into the mold.

The belt-type prefoamer is the predominant type of machine being used today, although there are several other methods using the same general principles. These methods are hot air-oven prefoaming (trays of beads are placed in a hot air-oven); hot water prefoaming (trays of beads are placed in hot or boiling water); and hot air chimney prefoaming (beads are expanded in a rising hot air stream). Basically, these methods operate on the same principles and provide the same prefoamed bead.

Molding

The prefoamed beads are now ready to be moved to the molding operation where they are placed inside the desired mold for the final expansion. Before describing the different types of molds that are used with this material, there should be some mention of the heating media used for bead expansion.

HEATING MEDIA. All that is necessary to expand the beads is the application of heat, and it has been found that several types of heat may be used. Among these are hot air, hot glycol-water solutions, and steam. Of these heat media, steam has been found to be the most efficient by far.

Steam at a pressure of 5-50 psi. can be used to heat the mold, or the steam can be put directly into the cavity itself by means of drilled holes in the cavity wall. Steam is the fastest heating medium available because of its high quantity of latent heat. Another advantage of steam is its uniform temperature which insures uniform expansion of all the beads and prevents shrinkage of the foam due to hot spots on the mold.

Foam may be made by using hot air-ovens or hot water-glycol baths but the resulting production rate is too low for economical manufacture of large-volume items. Hot air-ovens are used mostly in experimental and development work.

MOLD TYPES. Figure 3 shows the different types of molds that can be used with steam. The first basic type is the single-wall mold that is held together with suitable clamps. Both the ball mold and the probe mold are examples of single-wall molds. The ball mold can be heated either by conduction from the outside by placing the ball in an autoclave or, as is shown, small holes are drilled in the mold to permit the entrance of steam from the autoclave. Steam from the autoclave enters the mold and expands the material, with resulting condensed water being forced out of the parting line and the holes in the mold. An adaptation of this design is a probe mold in which a steam probe is inserted in one

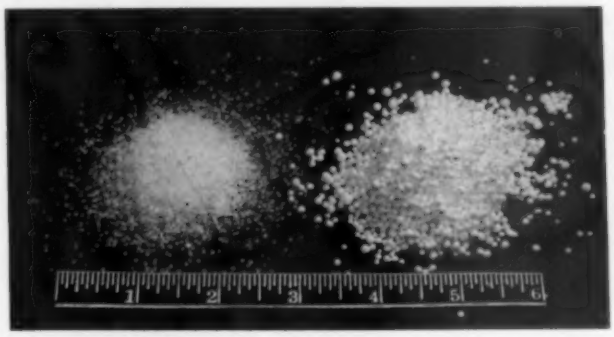


Fig. 1. Expandable polystyrene beads (left) as supplied, and (right) after prefoaming.

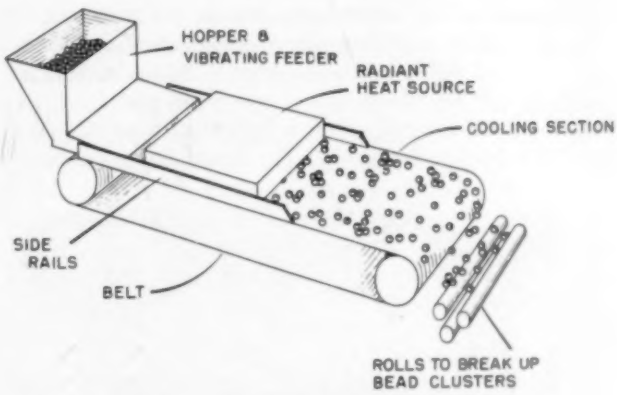


Fig. 2. Schematic drawing of belt-type prefoaming.

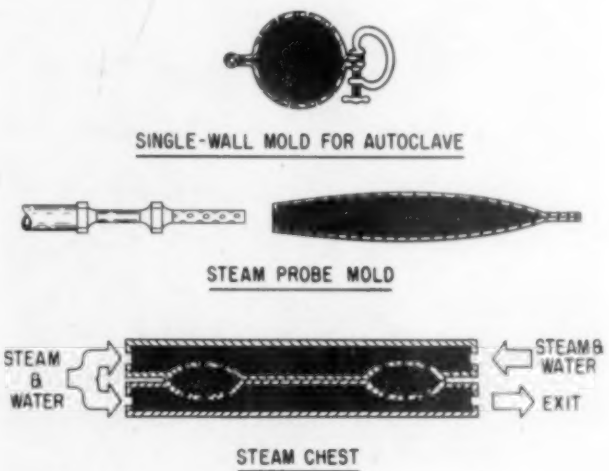


Fig. 3. Schematic drawings of basic types of molds.

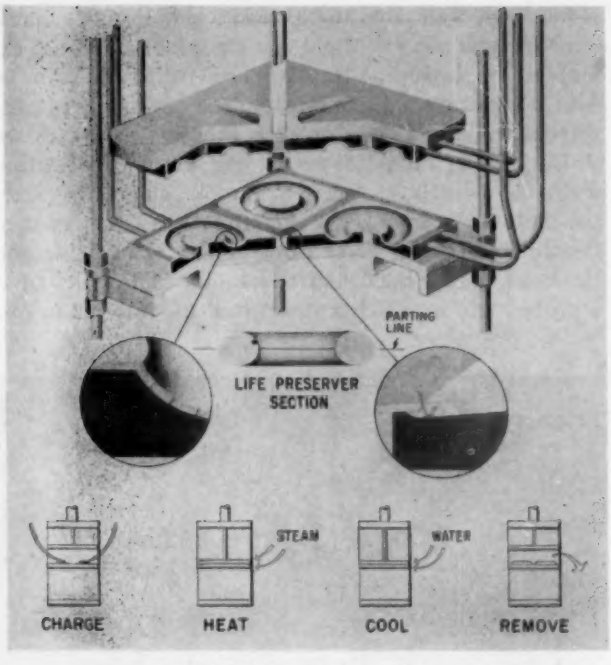


Fig. 4. Detailed view of steam chest molding.

end to deliver the steam necessary for heating the beads. The other basic and very commonly used type of mold is a steam chest mold. Here, a surrounding steam jacket is built around the mold cavity wall.

A steam chest mold is shown in greater detail in Figure 4. This is a four-cavity steam chest mold built into a press which opens and closes the mold. The left cut-away of the mold shows the steam chamber into which the steam enters and is forced through the small drilled holes into the cavity. The steam enters the cavity and expands the beads. After the heating cycle has been completed, cooling water is run through the same outer jacket to cool the foamed article before removal from the mold.

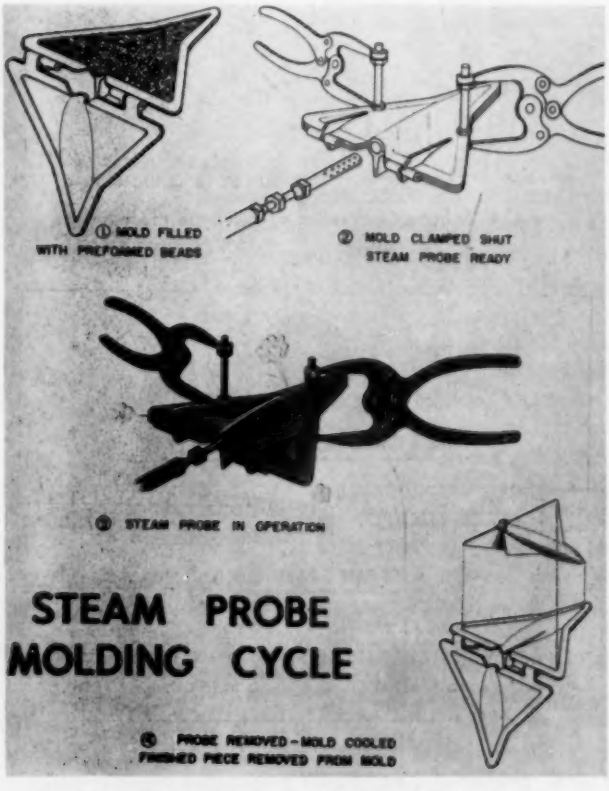

① MOLD FILLED WITH PREFOAMED BEADS
② MOLD CLAMPED SHUT STEAM PROBE READY
③ STEAM PROBE IN OPERATION
STEAM PROBE MOLDING CYCLE
④ PROBE REMOVED - MOLD COOLED FINISHED PIECE REMOVED FROM MOLD

Fig. 5. Details of steam probe molding cycle.

The steam chest method of molding has found wide acceptance because of its speed, adaptability to automatic equipment, and the opportunity for use of multiple-cavity molds. Automatic timers, loaders, and ejectors are on the market for use with this molding method.

The steam probe method also has found quite widespread acceptance for rapid molding. This method utilizes individual single-wall molds, with a probe used to deliver the steam for heating. A steam probe molding cycle is shown in Figure 5. The mold is filled with prefoamed beads, the mold closed and the probe brought into position. The probe is simply a pipe perforated to uniformly distribute the steam inside the mold. The probe is inserted and steam injected into the mold. If the probe hole should be closed up in the molded part, the probe is pulled out before cooling the mold. If the probe is left in while cooling the molding, the hole remains in the part. Molds are cooled in a water bath or spray. Multiple probes may be used for large pieces, and the design of individual probes may vary considerably.

A comparison of cycle times for the different molding methods is given in Table 1.

Table 1. Typical Molding Cycles for a One-Inch Section

Molding Method	Heating Time, Min.	Cooling Time, Min.	Total Cycle Time, Min.
Single-wall mold:			
Hot air at 350° F.	5-15	1-1½	6-16½
Steam autoclave at 30-40 psig.	3-8	1	4-9
Glycol-water bath at 300° F.	5	1-1½	6-6½
Steam chest	1/6-1	1-2	1 1/6-3
Steam probe	1/12-½	1	1 1/12-1½

In addition to the heating and cooling times shown in this Table, loading and unloading times also are necessary and generally take from 1-5 minutes. As can be seen the steam chest and steam probe provide the most rapid over-all cycles, but their choice over the other types of molding depends on the size, shape, and quantity of the article being made; the heating sources available; mold costs; etc.

Foam Properties

There are many materials that can be easily fabricated but certain properties make expandable polystyrene more desirable. Figure 6 shows that the flexural strength increases with the density of the foam. Flexural strength is important in any part that is subject to bending stresses. Another very important mechanical property is compressive strength, and in Figure 7 we have plotted the compressive strength at 5% deformation against density. A two-pound density foam has the compressive strength of 20 psi., while a 10-pound density

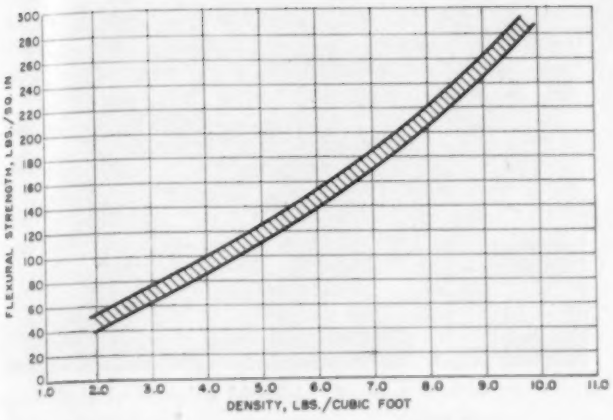


Fig. 6. Effect of foam density on flexural strength.

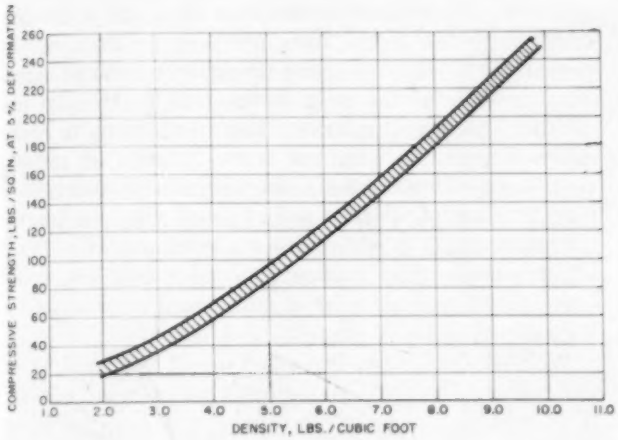


Fig. 7. Effect of foam density on compressive strength at 5% deformation.

foam goes up as high as 250 psi. The high strength-to-weight ratio of the foam makes it ideal for many applications.

Three other important properties of the foam are its thermal conductivity, water absorption, and water vapor transmission rate. The thermal conductivity, or K-factor, is the ability of a material to resist the passage of heat. Because of the foam's very tiny non-interconnecting cells, this insulating value of less than 0.22 BTU °F./hr./sq.ft/°F. is a very low one in comparison with other common insulations; thus, pointing to one of the foam's large-volume applications as an insulating material.

The water resistance properties also are excellent. Because of its cellular structure, there is no capillarity in the foam. As a result, water absorption and water vapor transmission values are practically negligible. The letter value is <2.0 perm inches, which classes the foam as essentially a vapor-barrier material. These water resistant properties and low K-factor make the foam an excellent low-temperature insulation, as well as a buoyant material.

Applications

Applications for expandable polystyrene are numerous and varied because there are no limitations to the sizes and shapes of articles which can be made. Because of its low thermal conductivity, low water absorption and high strength-to-weight ratio, one of the foremost applications is low-temperature insulation. Figure 8 shows how the material is used as an insulant in a liquid chiller. In this application, the beads are foamed in the annular space to give a completely-sealed insulation jacket around the chiller. In this case, the chiller itself is used as the mold. The blackened portion of the foam results from cutting the section with a band saw.

The refrigeration industry is using expandable polystyrene as wrap-around insulation for evaporators, drip pans, door latch insulation, and supports. Other markets for this low-temperature insulating material are as coverings for low-temperature pipe lines and equipment in refrigerated railroad cars, insulated cabinets and equipment, ice buckets, picnic coolers, and the like.

Another field of application is the novelties and toys. Expandable polystyrene has found wide acceptance in making attractive, low-cost toys having fine details and smooth surfaces. Toys and other articles may be left as is, or can be sprayed and flocked or coated.

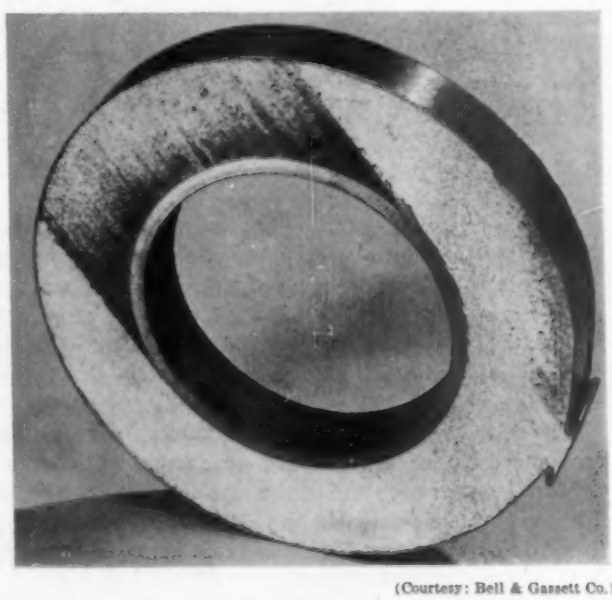
Low-cost letters, signs, and other displays are easily made from expandable polystyrene.

The buoyancy market has been a very excellent one for foam made from expandable polystyrene because it has a buoyancy in the range of 50-60 pounds per cubic foot, and will retain this buoyancy indefinitely. Some of the many applications for buoyancy-type articles are floating toys, industrial floats, fishing plugs, surf boards, and duck decoys.

Expandable polystyrene is a natural for the sandwich construction field where the foam can be used as a core between facings of many different types of materials, including metals, plastics, and wood.

The material can be used as a low-cost shock absorbent for packaging applications. It is also used as a low-density insulating filler when the beads are not fused together.

—The End



(Courtesy: Bell & Gossett Co.)

Fig. 8. Cross-section of a liquid chiller showing polystyrene foam used as annular space insulation.

(Continued from page 451)

nips instead of two, and makes it possible to do more mechanical work upon the material.

Among the various advantages claimed by the Z-type of roll arrangement is the fact that no roll has two banks diametrically opposite, thus eliminating the problem of stabilizing such a roll. This is also of considerable importance when double-coating fabric, since the variations in the working banks do not have much effect upon the gage being produced at the coated bank.

We feel, however, that the inverted-L type of calender is a slightly stiffer machine. In other words, the sum of the crowns on all four rolls is slightly less with the inverted-L than would be required to produce the same material in a Z-type calender. While this is not a large difference, it does increase the range of gages which can be run on the machine when crown-compensating devices, such as roll crossing and roll bending, are not provided.

To use roll crossing on the Z-type machine, the last roll must be crossed and doing this, it moves this roll slightly with respect to the first take-off roller or cooling drum. This may or may not be of concern to the plastic film manufacturer. With the inverted-L, the center roll of the vertical stack is crossed and the load effect upon the rolls is greater since crossing the center roll affects both the final bank and the bank between the top and middle rolls, and it also keeps the last roll from which the film is taken in alignment with the first take-off roller or cooling drum. While the inverted-L calender requires more head room than the Z-type, by the same token it requires less floor space. Also, in the inverted-L calender, it is easier for the operator to observe what is going on in all the various banks.

Beta-Ray Gage

The beta-ray gage used to automatically operate the roll screw-downs is another step in the direction of

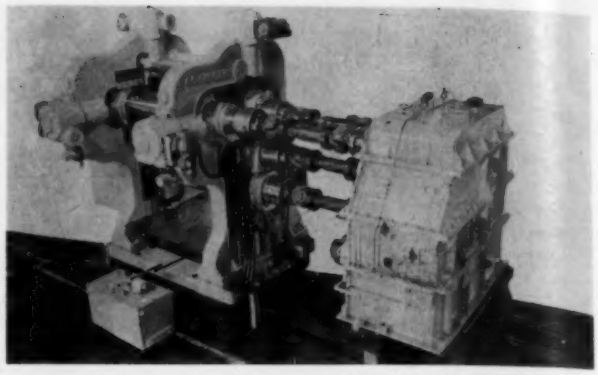


Fig. 7. 28 x 74-in. four-roll, inverted-L calender with roll bending on bottom roll.

sheet gage control. When operating with thin film, the problem is to prevent overshooting when the screws are operated by the signal from the beta-ray unit. At the present time, the slow-speed operation of plastic calender screws is in the neighborhood of 0.016 inch per minute. This still is relatively fast when trying to make minor corrections with the screw. Under the present conditions, however, the screw operates so slowly that both it and the low-speed gears (which drive the screw) are continuously operated under a break-away condition which reduces their efficiency to the extent where the over-all efficiency of a screw adjustment mechanism on a plastic calender is generally less than 1%.

We look forward to increased use of the beta-ray or some other means of automatically operating the screws. If it becomes necessary, designers will have to make slower moving screws. There are things which can be done in the calender design to help, but all of these changes will increase the cost of calenders.

Today, a new calender costs much more than the old-style calenders. The use of this automatic equipment also requires Class "H" insulation on the screw-down motors, another factor which will increase the cost of the machine.

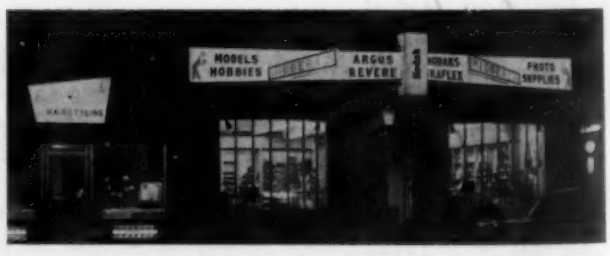
—THE END

Three-Dimensional Acrylic Sign

"A real attention-getter"—these were the words used to describe the sign over a photographic supply house in Philadelphia, Pa. Consisting of a three-dimensional reproduction of a film box, flanked by wide strips of acrylic, the sign was recently chosen "Sign of the Month" by vote of some 5,300 sign-makers throughout the United States.

Legible, shallow-formed black letters identify the products and services, while the store name and characteristic figures at each end of the sign are custom-formed from red acrylic plastic. Each side section measures 18 feet long by three feet high; the faces being 0.125-inch thick, white translucent panels.

The film box is authentically reproduced in yellow acrylic, with red cut-out letters. Measuring two by two



Sign by night, back-lighted to provide glare-free clarity.

by five feet, the box is lighted internally with white neon which flashes on and off. All acrylic material in the sign as well as light enclosures are Plexiglas, a product of Rohm & Haas Co., Philadelphia, Pa.

—THE END

Guest Editorial

Moffett Chicago

The Need for Research, Development, and Quality Control

CARL F. MASSOPUST, *Director of Research and Development, Plastics Division, General American Transportation Corp, Chicago, Ill.*

Although raw material manufacturers have maintained extensive research and development facilities for many years, the branch of the plastics industry concerned with the manufacture of plastic products has been quite weak in this respect.

Also, few plastics molders and extruders maintain adequate quality controls on incoming molding and extrusion materials. The material supplier is not infallible and, on occasion, may inadvertently ship molding or extrusion materials which do not come up to standards. Admittedly, the best way to prove out a molding material is to run it in an injection or extrusion machine, but this procedure can and occasionally does lead to disastrous results.

Too often, trouble is not detected until a production run is well under way and the plastic firm's inspection department has to halt production because of off-color, contamination, poor physicals, or a customer's complaint. If the molder or extruder is fortunate, he may have batches of the material in stock which are not questionable, and so is able to continue production. Often, however, his entire inventory may be suspect, resulting in serious delays. At any rate, the problem is finally resolved by a meeting between the material supplier's technicians and the molder, at which time responsibilities are established and an adjustment made.

In the meantime, the final customer has suffered at least some inconvenience due to the effect on his operating schedules during the time the part has been out of production. The molder or extruder has been doubly hurt by loss of production time and loss in direct labor and overhead. The effect of this delay on customer relations has very tangible dollar value.

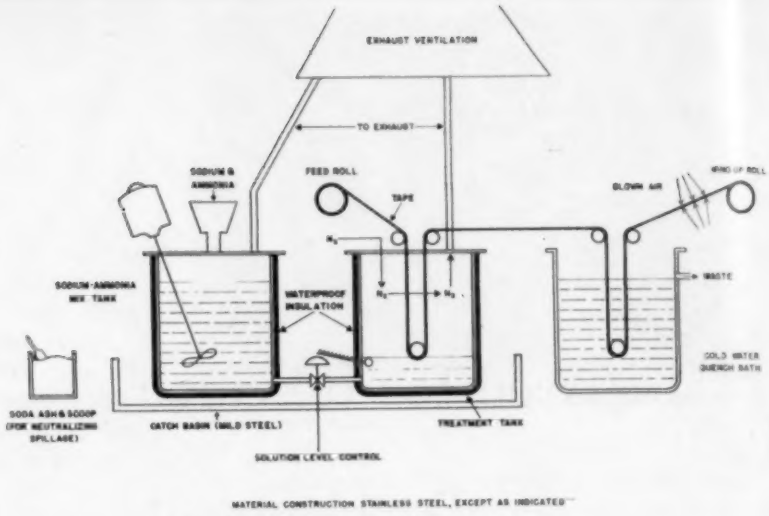
Contrast this situation with that of the metals industry. The writer recalls, in particular, his employment while a college student in a plant using a modest amount of pig lead. Every shipment of lead was sampled and tested before removal from the freight car on a test basis established by mutual agreement between the supplier and the user. Trouble was located and adjustments made easily before release of the material to the production department.

Quality control of plastic materials is perhaps more difficult than that of metals. However, our past experience has proved that such control can be accomplished and does result in a dollar savings as well as in a more pleasant supplier-customer relationship, with less down-time and fewer interruptions in the final user's production line.

With the rapid growth of our industry, it is inevitable that potential customers for plastic products will specify physical characteristics which will require knowledge of technology and the use of scientific control of production operations. The specification of minimum physicals, such as elongation, impact, and tensile strength, for example, insures minimum degradation of an extrusion or injection molded item.

—THE END

Preparing Teflon for Bonding



Schematic diagram of Teflon treating process.

The unique, slippery surface of fluorocarbon resins makes them invaluable in a number of operations which require the handling of tacky materials. This selfsame property, however, presents a grave problem—that of adhesion.

A new method of obtaining a cementable surface on Teflon, Du Pont's tetrafluoroethylene resin, has been developed by that firm's polychemicals department. The procedure involves, in essence, the immersion of Teflon in a bath containing metallic sodium in anhydrous ammonia. The resulting surface can be bonded to a variety of materials, including Teflon, with conventional adhesives. Material properties are not affected significantly.

The sodium is dissolved in ammonia to a maximum concentration of about 1%. Stainless steel containers of a height 1.5 times the diameter are recommended to insure complete blanketing with ammonia and nitrogen vapors at all times. In addition, it was found that a protective barrier of polyethylene film and the continuous addition of nitrogen gas were helpful in excluding moisture.

Volume of the solution depends upon the amount of material to be treated, but should be limited in order to avoid sodium accumulation. Du Pont recommends a bath of 15 grams sodium to 1,500 grams of liquid ammonia for hand dipping 30 feet of tape, eight inches wide by 10 mils thick. Inmersion time ranges from one to five seconds, following a thorough cleaning with a solvent such as acetone. After immersion, the Teflon is washed in cold water to remove residual agents. When dried, the metallic luster disappears and a dull brown color remains. Care should be taken at all times, since both metallic sodium and liquid ammonia are hazardous chemicals.

—THE END

Plastic Facing on Huge Kirksite Drop-Hammer Dies

39,000-pound drop hammer die of Kirksite capped with plastic is used by Republic Aviation to stamp out aircraft parts.

A plastic facing for Kirksite drop hammer dies has been developed to the point where both punch and die portions totalling 39,000 pounds have been produced by Republic Aviation Corp., Farmingdale, N. Y. Several pairs of these mammoth tools have been used successfully in forming aircraft parts, and patent applications are being filed.

The tools were designed by the company's manufacturing research and development, department, and made in Republic's foundry. Continued research on plastics has produced a wide variety of plastic tooling, and more

(Continued on page 462)

Long-Term Strengths of Reinforced Epoxy Pipe*

Results of long-term burst tests of reinforced plastic pipe show the role of surface chemistry in solving structural problems

H. D. Boggs, *General Manager,*
Fibercast Corp.
Sand Springs, Okla.

Studying the stress, creep, and time-dependent characteristics of glass-reinforced plastic pipe has opened new vistas of understanding on how and where to use the material. Of even more importance, however, the work defined what the material really is. We, like others, enjoyed the Hollywood-style fanfare about reinforced plastic pipe, and it was a jolt to settle down to the hard, cold facts and realize that as an industry we are much more closely related to the glue works than to the movies. We have really substituted inorganic synthetic fibers for nature's organic fibers and synthetic glues for the stinking old "hoof glue," yet the new glues are still malodorous. Finally, the end-product is the result of thousands of minute glue lines subject to all the laws of surface chemistry.

Test Factors

Our pipe is reinforced with layers of braided glass sleeve which we call the "cage." The interwoven layers of the cage give it body and shape to resist displacement during handling. Furthermore, the cage has a definite geometric pattern and, as such, is subject to rather precise mathematics. Even so, the development of a strength formula seemed improbable until we began using the published minimum bursting value for the given yarn as the basic fiber strength unit.

Thereafter, it was merely a matter of multiplying the number of ends by this unit and by the trigonometric function of the helix angle of the braid to arrive at a unit strength, in pounds per inch, for the braided sleeve in either hoop tension or in axial tension directions. To convert the strength in pounds per inch to pipe tension in psi., we added the area factor by using the cast thickness of only the reinforced section of the pipe. We completely discounted the resin-rich inner liner of the pipe, since it adds only about 2% to the over-all results.

* Based on a paper presented at the twelfth annual National Technical Conference, Society of Plastics Engineers, Inc., Cleveland, O., Jan. 18, 1956.

Table 1. Pipe Burst Test Conditions and Results

Resin	Reinforced Wall Thickness, In.	Burst Pressure, Psi.	Hoop Stress At Burst, Psi.	Max. Long-Term Tested Operating Pressure, Psi.	Hoop Stress at Max. Operating Pressure, Psi.	Mechanism of Failure
"A"	0.240	5,600	41,000	900-1,000	7,600	Bond to glass.
"B"	0.240	5,600	41,000	1,300-1,400	10,200	Resin fracture and bond to glass.
"C"	0.240	5,600	41,000	1,900-2,000	14,600	Resin fracture.
"D"	0.240	5,600	41,000	3,500-3,600	26,000	Elastic limit of resin.

Once we had the basic units selected and checked, the formulas quickly became standardized and we had reached a design point worthy of trial. We designed cages with variations of helix angles, fiber sizes, placements of axial fibers, etc. Pipes so made were quick-burst or axially pulled, and it was found that actual strengths compared closely with the computed strengths, usually exceeding the calculated values by about 10%. Results were reproducible at will.

Further studies developed several important design limitations, the two most important being as follows:

(1) There is a maximum glass loading for a given resin and a given process.

(2) Variations in the quick-loading rate result in variations in the test values obtained; hence, it is necessary to define the quick-loading rate.

Glass Content

While this discussion is directed at the resin and its relationship to the long-term strengths of the pipe, it is important to lay the foundations by explaining the functions of the cage. For example, maximum glass loading is a function of both the wetting quotient of the resin and the process forces. If they are nearly in balance, the use of additional glass content will result in dry laminates. Our test results indicate that higher burst strengths are achieved as the glass content is increased and, after reaching a maximum point, the strengths decrease as the glass content is further increased. This, of course, is an old story in surface chemistry phenomena, and is a function of the surface tension of the resin, the glass finish, and the impregnation forces (in our process, these forces are centrifugal).

Loading Rate

We noted variations in results due to changes in burst loading speeds. While loading speeds with conventional testing equipment are standardized, the burst testing of pipe presents complications. It is important, however, to regulate the loading speed since all the fibers in the structure are not under equal tension, and the stress is delivered through the resin from fiber to fiber. So long as the loading rate is sufficient to transmit the stress from fiber to fiber before the resin structure or the resin-to-fiber bond fails, the test is within the range of short-term failure and this failure will break the glass structure. It is possible, however, to progressively snap the fibers, beginning with those in greatest tension; hence, loading speed is a critical factor.

As previously indicated, a standardized loading speed for pipe burst tests presents problems since the variations in pipe size alone eliminate the common denominator of a standard shape of pull bar. Unfortunately, tests made on partial sections of pipe are worse than no tests at all, so all tests must be made on full sections of pipe in order to obtain valid data. We attempt to maintain a hoop stress loading of 75,000-100,000 psi. per minute, resulting in burst test durations of less than one minute. We burst each test sample in a predetermined fashion, such as planned incremental increases in water pressure per second, etc. Test conditions, therefore, can be reproduced only through careful attention and planning.

As the picture unfolded for us through the medium of these tests, we could not help looking back over the mass of published test data and wondering how many variables, such as loading speed and maximum glass loading, were present in the published tests.

Test Results

Figure 1 shows the stress pictures we obtained for 3½-inch O.D. pipes made with four different resins; two polyesters and two epoxies. Test conditions are given in Table 1. The reinforcing cage was identical in all pipe specimens, and each pipe was cured under optimum conditions for the resin employed.

Resin "A" is a low-modulus polyester, and withstood close to 1% deformation before bond failure; however, it did not require more than 2,000 psi. of water pressure to cause the 1% deformation. There was no question that the chief mechanism of failure was the rupture of the glass bond. Resin "B" was an all-rigid polyester of medium reactivity during cure. Resin "C" was a typical brittle epoxy resin with a hardener curing system.

Resin "D," a tough epoxy, was found to be the most ideal we have tested for room temperature applications but, unfortunately, cannot be processed readily because of its low heat distortion point (130-140° F.). This resin with glass fibers has a modulus of elasticity of 4,000,000 psi., and will withstand 1-1.2% deformation in a 55% glass structure before failure. The industry needs this type of resin with a heat distortion point of 250° F.

Referring to the diagrams of Figure 1, you will note that we have pictured at the end of the scale a "short-term" stress area which is controlled by the glass structure. At the beginning of the scale is a "long-term" stress area which is controlled by the resin. Between these two stress areas is an unknown area. If the resin

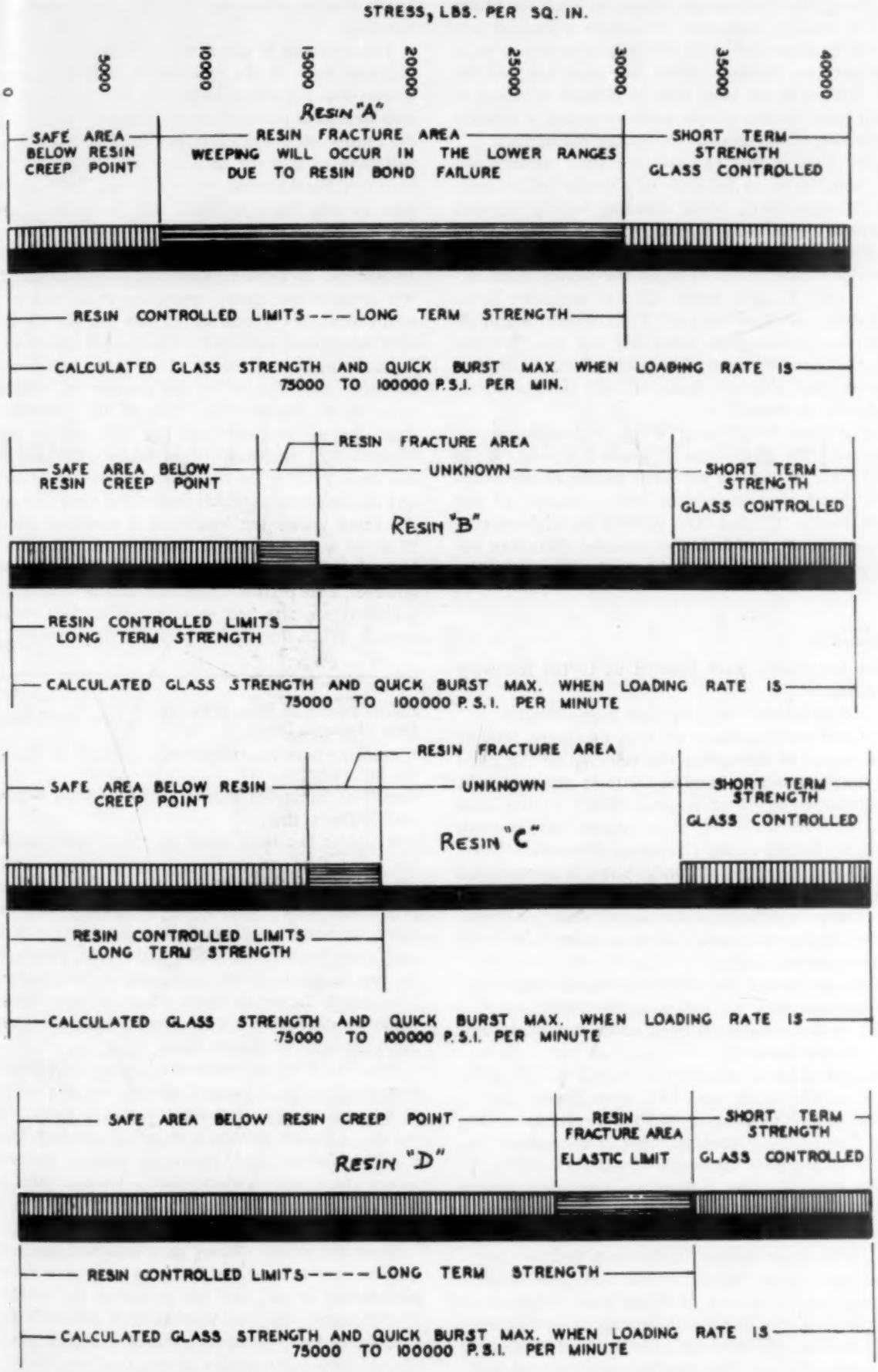

STRESS, LBS. PER SQ. IN.
0
5000
10000
15000
20000
25000
30000
35000
40000
RESIN "A"
SAFE AREA BELOW RESIN CREEP POINT
RESIN FRACTURE AREA
WEEPING WILL OCCUR IN THE LOWER RANGES DUE TO RESIN BOND FAILURE
SHORT TERM STRENGTH GLASS CONTROLLED
RESIN CONTROLLED LIMITS --- LONG TERM STRENGTH
CALCULATED GLASS STRENGTH AND QUICK BURST MAX WHEN LOADING RATE IS 75000 TO 100000 P.S.I. PER MIN.
SAFE AREA BELOW RESIN CREEP POINT
RESIN FRACTURE AREA
UNKNOWN
SHORT TERM STRENGTH
GLASS CONTROLLED
RESIN "B"
RESIN CONTROLLED LIMITS LONG TERM STRENGTH
CALCULATED GLASS STRENGTH AND QUICK BURST MAX. WHEN LOADING RATE IS 75000 TO 100000 P.S.I. PER MINUTE
SAFE AREA BELOW RESIN CREEP POINT
RESIN FRACTURE AREA
UNKNOWN
SHORT TERM STRENGTH
GLASS CONTROLLED
RESIN "C"
RESIN CONTROLLED LIMITS LONG TERM STRENGTH
CALCULATED GLASS STRENGTH AND QUICK BURST MAX. WHEN LOADING RATE IS 75000 TO 100000 P.S.I. PER MINUTE
SAFE AREA BELOW RESIN CREEP POINT
RESIN "D"
RESIN FRACTURE AREA ELASTIC LIMIT
SHORT TERM STRENGTH
GLASS CONTROLLED
RESIN CONTROLLED LIMITS ---- LONG TERM STRENGTH
CALCULATED GLASS STRENGTH AND QUICK BURST MAX. WHEN LOADING RATE IS 75000 TO 100000 P.S.I. PER MINUTE

Fig. 1. Stress pictures obtained in tests of 3½-inch O.D. glass-reinforced resin pipes: (top to bottom) Resin "A", a low-modulus polyester; Resin "B", a tough polyester; Resin "C", a brittle epoxy; and Resin "D", a tough epoxy.

fails during test, the sample creeps to such an extent that it is usually impossible to sustain a loading rate sufficient to cause failure of the glass structure. This is not important, however, since the pipe has already failed. Failure in the resin body is difficult to detect in pull-bar tests; for this reason, pressure testing is superior in permitting observation of the failure mechanism.

Figure 1 shows that (1) safe operating pressure can never be achieved on the basis of ultimate failure data; and (2) creep level, while differing widely between the various resins, was dependent in all cases on the resin characteristics.

Elevated temperatures changed the picture considerably. At 180° F., only Resin "C" was operative. Resin "D" became too elastic at 140° F. to remain useful, although the resin-to-glass bond did not fail. Neither Resins "A" nor "B" would last long at 120° F. at very low stress level, although Resin "B" did show a slower rate of creep to destruction.

Even at room temperature, it was evident that water was entering the glass cages of Resins "A" and "B" at a rapid rate, so that the extent of failure of the resin-to-glass bond was more than 50%. Neither of the epoxies, Resins "C" and "D," showed the slightest sign of water admission; this is the essential difference between polyester and epoxy resins in the long-term picture.

Conclusions

These test results have brought us to the following conclusions:

(1) Resins control the long-term pipe strengths.

(2) Glass reinforcement up to a maximum loading content serves to strengthen the resin up to the point where the glass-to-resin bond or the resin structure fails. This strengthening effect is proportional to the glass loading content while the glass content ranges from 25-65% by weight of the reinforced structure.

(3) A continuing growth under stress is a creep, and results in destruction.

(4) Creep is influenced by stress, time, and temperature. An increase in any of these three factors will accelerate creep to failure.

(5) Resins useful for sound structural plastic applications must have the following characteristics:

(a) Adhesion to glass even under water-saturated environment.

(b) Modulus of elasticity in excess of 3,500,000-4,500,000 psi. with 55% glass fibers.

(c) Ability to elongate 0.9-1.2% without failing or reaching its elastic limit in a structure containing 55% by weight of glass.

(d) Retention of adhesion and a minimum modulus of 2,500,000 psi. at 200° F.

(e) Controlled cross-linking to prevent residual shrinkage stresses in the resin body.

These conclusions add up to the fact that the glass cage, made up of bundles of fibers, must be glued together. As with any glue line, the energy of wetting must be very low, and the adhesion excellent and resistant to environmental attack. The glue line must stretch without failing at the bond line or in the glue body, even under repeated or cycled loads. In addition, the glass fibers must be clean and free of any interference with bonding.

The evidence is plain; we must redouble our efforts and aim them at the concept of surface chemistry. If a resin does not adhere to glass, it must not be fabricated into structural plastics because failure is certain. Before the reinforced plastics industry can become healthy, we will have to face the facts and talk in terms of a glue industry. Furthermore, we must have better glues before we can begin to utilize the potential strength of the reinforcing cage.

We have reached a safe long-term stress level of 14,000 psi. in certain reinforced plastic combinations. We know of one epoxy resin-glass reinforced structure which sustained a load of 26,000 psi. for six months, after which tests indicated a 5% over-all loss of strength. Of the hundreds of resins of all types which are now available, only five or six are capable of withstanding stress levels representing 35% of the potential glass cage strength, and only one has 60% of this potential strength. The vast majority of resins will safely sustain less than 15-20% of the potential glass cage strength, and the seven resins which exceed this range are epoxies. All these values are based on a structure containing 55% by weight of glass. Temperatures of 180° F. or higher make this picture much blacker. We believe, however, that present conditions can be changed if the problems are attacked in terms of surface chemistry.

—The End

Plastic Facing on Huge Kirksite Drop Hammer Dies

(Continued from page 458)

than 800 laminated plastic parts used on current assembly-line planes.

Republic has been using the plastic-capping process for some time on smaller drop hammers, where the process saves from 50-500 hours or more in tool production time. The facing eliminates the need for extensive hand grinding of Kirksite metal dies before and after brief use periods. Either the punch and/or die can be plastic-faced, using epoxy resin compounds. The punch facing is made of a resilient compound, while the die facing is a hard epoxy compound containing tough, wear-resistant fillers.

After the Kirksite female die has been rough-cast, the matching punch is poured against the die, using clay to take up the gap left for the plastic faces. To face the die, a plaster pattern is mounted one inch from the Kirksite surface, and plastic is poured between the plaster face and Kirksite core. To face the punch, the core is suspended one inch away from the die face and the gap filled with plastic.

Since the plastic facing is tough and resilient, the tools are not as large and heavy as normal to absorb the punishment of use, and the press can be smaller. The 39,000-pound die combination has 38,550 pound of Kirksite and 450 pounds of plastic. Without the plastic facing, drop hammer dies of this size and shape would not have been practical.

—The End

Stretching Large-Area Acrylic Sheets

Details of an experimental machine, readily converted to production use, for uniaxial stretching of large cast acrylic sheets.

ALFRED BATZDORFF, *Plastics Laboratory, Rohm & Haas Co., Bristol, Pa.*

The past 10 years have witnessed the development of a wide range of commercial applications for cast acrylic sheets. During that time, the dominant tendency has been toward ever larger formed parts because the applications proved most successful have been based on the use of large areas of color and light. These are applications such as spectacular sign faces and giant dome skylights. Some of the sign faces are so large that they cannot be made of single sheets, and must be made by cementing or mechanically joining together two or more sheets.

At the Rohm & Haas fabrication laboratory, we have recently investigated the possibility of stretching large cast sheets to obtain the sizes required to form extra-large articles from single sheets. While our experimental work was limited to stretching a 67 x 102-inch sheet to a size of 102 x 102 inches, the results indicate that the same stretching principles can be applied to even larger sheet sizes.

Experimental Machine

A machine was designed and constructed (see Figure 1) which will stretch heated acrylic sheets in one direction, while holding them in the other direction to prevent them from necking down. It was found practical to stretch 0.250- and 0.375-inch thick Plexiglas sheets measuring 67 x 102 inches to a stretched size of appromiately 102 x 102 inches at a stretching rate of approximately seven inches per minute.

The sheet is gripped along the edges by knurled eccentric roller clamps which increase their grip on the sheet as it is stretched. The vertical clamps (see Figure 2) remain fixed to the vertical clamping beams, while the horizontal clamps (see Figure 3) have roller legs so that they can move horizontally with the sheet as it stretches. The whole machine is hung from an overhead trolley rail so that it can be moved easily into the oven and to the forming apparatus.

In operation, the cold sheet is clamped into the machine (see Figure 4) which is then moved into the oven. The stretching cycle is started after the sheet has reached forming temperature. Since the machine remains in the oven during the entire stretching operation, the stretched sheet is fully heated and ready for forming at the end of the stretching cycle. The machine with the heated stretched sheet in place (see Figure 5) can then be moved to the forming equipment, which should be positioned to close horizontally so that the sheet can be formed immediately without being removed from the stretching machine. If the stretched sheet must be cooled and removed from the stretching machine, it

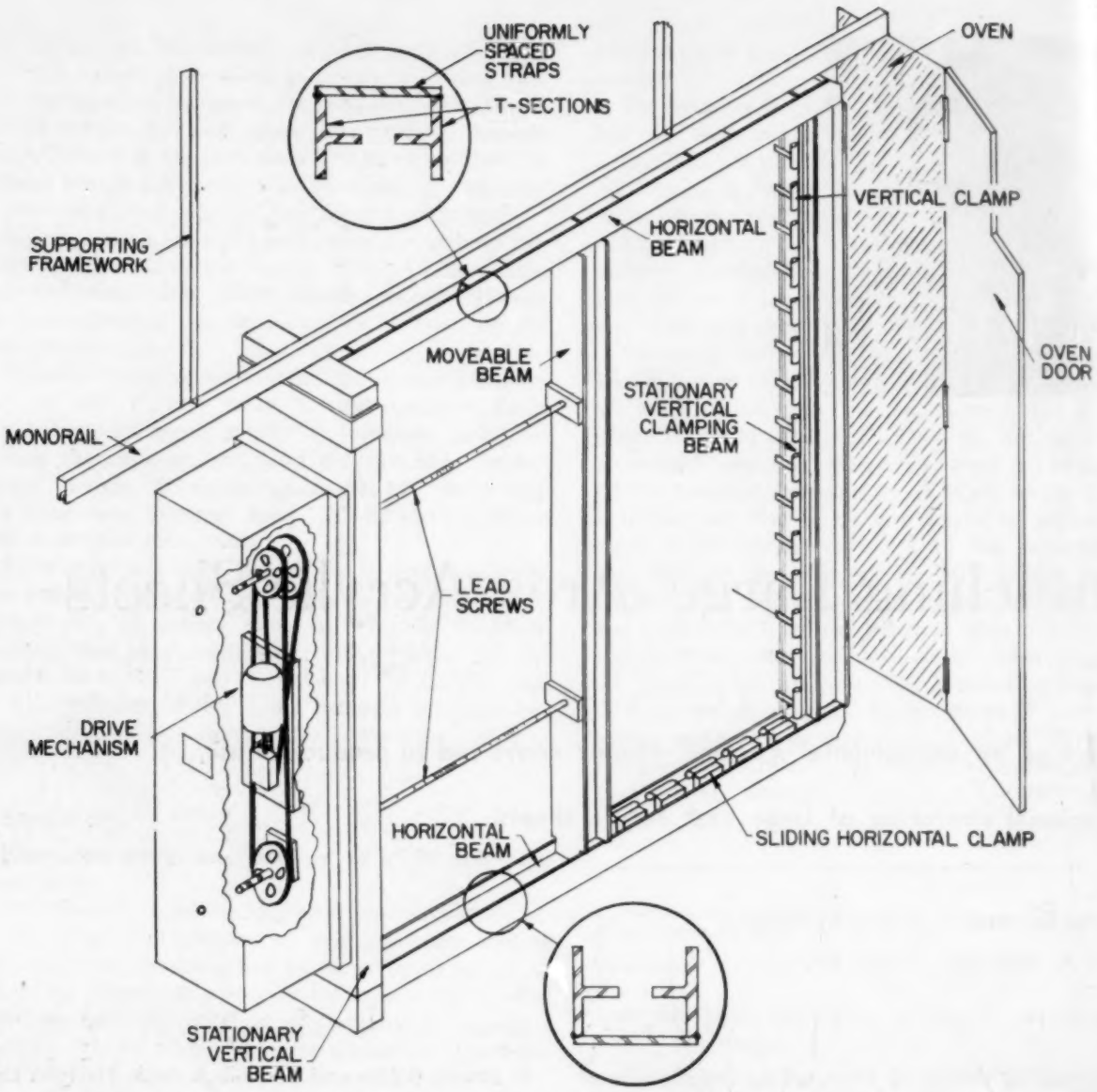


Fig. 1. Schematic drawing of axial sheet stretching machine.

will be necessary to clamp the sheet in a tenter frame to prevent it from shrinking back to its original size when it is reheated.

The stretching is accompanied by a reduction in thickness which is inversely proportional to the amount of stretch. For example, a sheet originally 0.375-inch thick and 67 inches wide will reduce to a thickness of approximately 0.250-inch when stretched to a width of 102 inches.

Production Machine Design

A machine which is expected to operate as permanent equipment in a fabricator's plant may be "automatized" to a considerable extent to reduce the labor cost. For a low production rate, a compact automatic machine could be designed that would necessitate manual labor only for loading and unloading, permitting the operators to work on another job for 45 minutes out of every hour.

To speed up the cycle, a machine could be constructed to unload as soon as the press is closed and, thus, avoid tying up the machine during the sheet-cooling period. To effect this, the stationary clamping beam would have to be detachable, so that the rest of the machine might be withdrawn like a giant "C"-frame. This, however, might be an expensive modification at a relatively small saving in machine time. Another possible alternative would be to build two machines with a track system that would permit one machine to enter the oven as the other comes out. It is probable that construction costs could be reduced by the design of a multiple machine system with some of the components of the controls and drive mechanism being stationary and suitable for either machine when positioned at any one station.

Test Results

Qualitatively analyzing the test results, it was found that after all conditions with respect to time cycle and temperature had been determined experimentally, there was not a single failure either in sheet tearing, in clamp slippage, or in functioning of the equipment. It seems

evident that time and temperature cycles would have to be determined experimentally for each machine and oven installation, since they depend on BTU input, hot air circulation, and machine mass. Care must be taken to build the oven sufficiently large so that air circulation will be adequate even with a large sheet suspended in the oven.

In the original experimental set-up at our laboratories, the oven was run at 145° C. during the stretching cycle. However, the oven was preheated to 180° C. to counteract the cooling effect of the large cold mass of the machine and the sheet. As soon as the cold machine and cold sheet entered the oven, the temperature fell sharply to about 145° C. The thermostat was then reset to control the oven at that temperature. The total pre-stretching oven time for ¼-inch thick sheet was 20 minutes; for ⅜-inch thick sheet, 30 minutes.

The sheet was stretched in the oven at a rate of approximately seven inches per minute. Immediately upon completion of the stretching cycle, the machine was taken out of the oven. After the sheet had become partially rigid, the clamps were opened. Thus, sheet 67 inches long was stretched to 102 inches. In accomplishing this, the sheet was thinned out by approximately 33.5%. This meant that ⅜-inch thick sheet would emerge from this stretching operation as ¼-inch thick sheet, and ¼-inch thick sheet would emerge as $^{3}/_{16}$-inch thick sheet.

The thickness uniformity of the stretched sheet is remarkable, and often superior to that of the original cast sheet. This excellent thickness distribution is important not only from the viewpoint of strength, but also with respect to color concentration in pigmented sheet.

—THE END

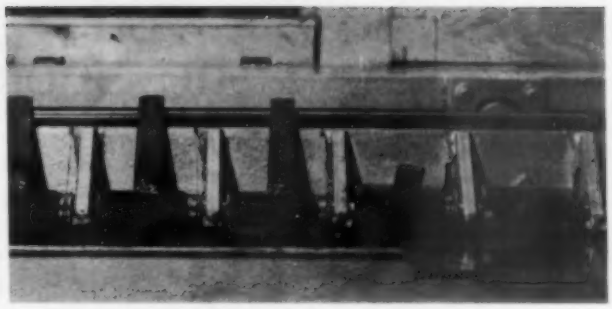


Fig. 2. Detailed view of vertical clamp.

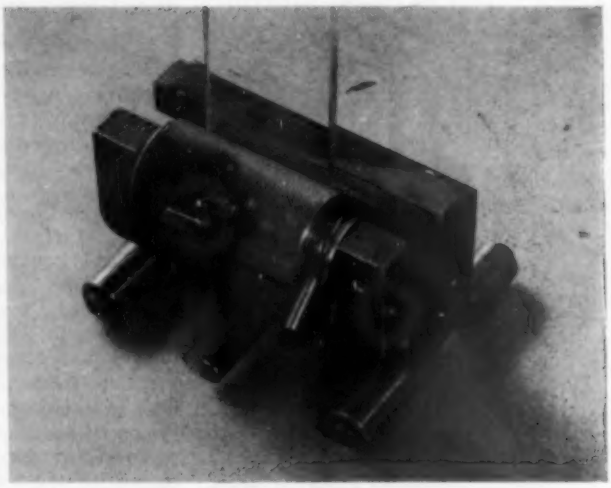


Fig. 3. Detailed view of sliding horizontal clamp.

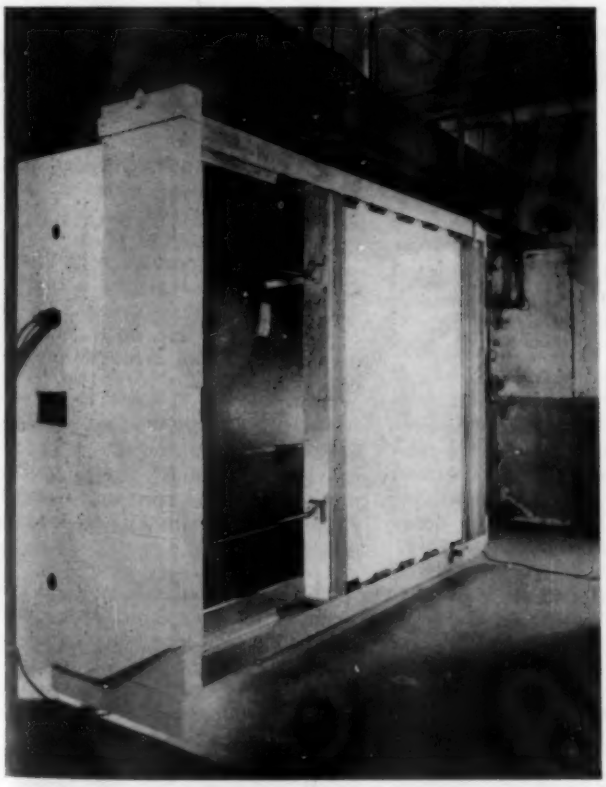


Fig. 4. Stretching machine with clamped sheet before stretching.

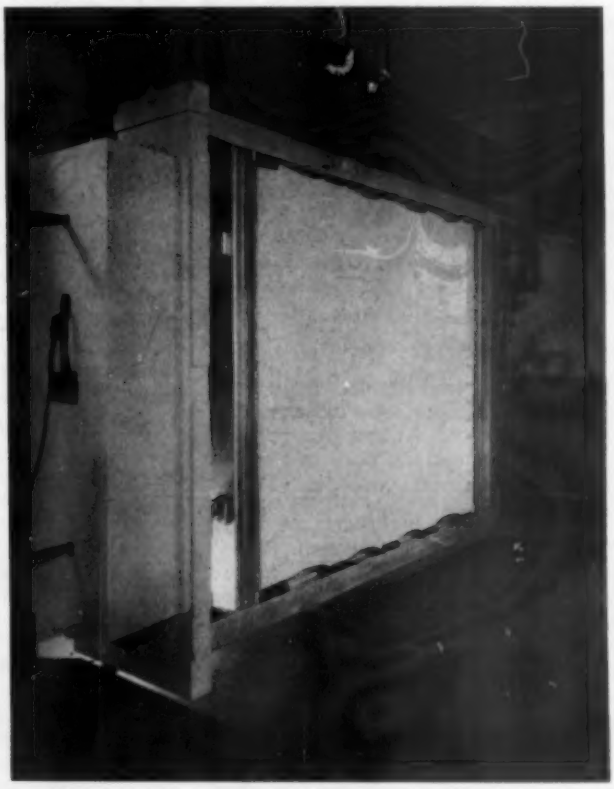


Fig. 5. Stretching machine after completion of sheet stretching.

News of the Societies

Optimism Voiced at Sessions of SPI Annual Conference

"Plastics Shaping Tomorrow's Products" was the theme of the 1956 Annual Conference of the Society of the Plastics Industry, Inc., held at the Commodore Hotel, New York City, on June 11-15. The meeting was held in conjunction with the Seventh National Plastics Exposition (see page 469), and the sessions were arranged so as not to interfere with exhibit hours at the show. Paid registrants at the Conference totaled 832, as compared with 1,058 at the 1954 Conference, but attendance at the sessions was over 1,800 persons because of the many industry customers who were invited to attend.

The sessions covered almost every phase of plastics application. On June 11, there were concurrent morning sessions on cellular plastics and sheet forming. The general introductory session and keynote addresses were given in the morning session on June 12. On Wednesday morning, June 13, there were three concurrent sessions on automotive, packaging, and building materials applications, followed by the SPI annual meeting and luncheon. Two concurrent sessions, refrigeration and air conditioning and communications, were held on Thursday morning and followed by a luncheon session. The final morning, June 15, was devoted to a meeting of the SPI Molders' Management Division.

On the social side, the SPI annual reception took place in the evening of June 12; the international reception and dinner took place on June 13 at the St. Moritz Hotel; and a moonlight cruise, with dinner and dancing, was held on the M. V. Liberty Belle on June 14.

Abstracts of the papers presented at the session follow:

Cellular Plastics Session

This session was devoted to cellular plastics in the transportation industry. Paul Roach, United States Rubber Co., presided over the session, and the opening remarks were made by Samuel Steingiser, Mobay Chemical Co.

"Cellular Plastics Applications in Ships," John B. Alfers, Navy Department Bureau of Ships. The major areas of application are life saving, boat buoyancy, thermal insulation, void fillers, float fillers, structural sandwiches, and fire brick spacers. For life saving, boat buoyancy, void fillers, and float fillers, plastic foams have substantially replaced the conventional buoyant materials of 10 years ago. Since plastic foams possess the two characteristics of lightweight and water exclusion very important in naval applications, they are expected to find ever-increasing use as ship designers and builders become more familiar with them.

"Cellular Plastics in Subway Seating," J. R. McCormick, New York City Transit Authority. A review of current research, development, and specification work in progress on plastic foams for subway seating use.

"Cellular Plastics in Air Transportation," Stanley Lippert, Douglas Aircraft Co. Douglas is conducting much work on latex, polyurethane, polyether, and closed-cell vinyl foams. In discussing this work and the results to date, the speaker noted that information currently available on polyurethane foams indicates that they will not be satisfactory for use alone. Preliminary tests on the polyethers show promise, but more work is needed. Uses of closed-cell vinyl foam to date have been very satisfactory.

"Cellular Plastics in the Automotive Industry," E. J. Storfer, Chrysler Corp. There is great interest in polyether foam which reportedly has compression-set properties approaching those of latex foam. Latex foam has been more satisfactory for automobile upholstery and seating than vinyl or urethane foams.

"Applications for Cellular Plastics in Trains," Irving Einhorn, Budd Co. Foamed-in-place isocyanate seems to be the most rapidly expanding foam material in train applications because of its heat resistance. Rigid polystyrene foam and phenolic foam is finding some use in thermal insulations, particularly in sandwich constructions.

Sheet Forming Session

John W. Knight, Fabri-Form Co., presided over this session, which saw the presentation of the first two talks given below. This was followed by a panel discussion of "Transportation Applications for Sheet Formed Plastics," moderated by A. E. Polson, Goodyear Tire & Rubber Co., at which the last three talks were given.

"Use of Sheet Formed Plastics in Packaging Applications," R. N. Fisher, The Stanley Works. A review of packaging applications for plastics in the hardware industry, with emphasis on the need for setting up standards on plastic materials and adhesives, and the need for reduction in material costs.

"Applications and Requirements for Formed Sheets in the Appliance Industries," Robert Dixon, Westinghouse Electric Corp. Present trend toward built-in home appliances forecasts wider use of formed plastic sheet. For the heavier appliances, formed sheet can give thinner sections than injection molding, and the saving in material results in approximately equal costs for the two processes.

"Applications for Sheet Formed Plastics in the Automotive Industry," R. F. Hintermeister, Ford Motor Co. Current uses of formed sheet include headlinings, steering pillar covers, instrument panel crash pads, seat side shields, and door trim panels. Future increases in volume of automotive applications will depend on improvements in appearance of the formed sheet, its sound absorption characteristics, and its cost.

"Applications for Sheet Formed Plastics in the Railroad Industry," Ralph Haman, Pullman Standard Car Mfg. Co. Railroads are showing intense interest in plastics, ranging from the isocyanates (for insulation, cushioning, and mattresses) to melamine (for dinnerware). The most important consideration is the reduction in weight and maintenance offered by plastics.

"Applications of Formed Sheet Plastics in the Aircraft Industry," H. H. Rosenbaum, Convair Division of General Dynamics Corp. The lightweight of plastics make them ideal for aircraft applications, provided other service requirements can be met. The aircraft industry wants to keep abreast of the latest developments in plastics as materials of construction, and requests the dissemination of adequate technical data on the materials.

General Introductory Session

This session consisted of keynote addresses on the Conference theme which were presented after opening remarks by the presiding officer, W. T. Cruse, executive vice president of SPI.

"Plastics in the Automobile Industry," H. E. Chesebrough, Chrysler Corp. The automobile industry offers a tremendous potential market for plastics if they can meet the expectations of current research trends in the automotive field. These trends are toward transparency above the belt line, the use of component parts designed to last for the life of the car, and the obtaining of more favorable power-weight ratios.

"Packaging," C. W. Harper, Sears, Roebuck & Co. Plastics will play an increasing role in "hard goods" packaging, but lower tool and material costs and recognition of packaging requirements for lower-volume goods are needed.

"Building Materials," Ralph Walker, Voorhees, Walker, Smith & Smith. Plastics are finding ever-increasing use as building materials, and the outlook for the future sees their use as esthetic materials to meet modern requirements for beauty and design in construction.

"Refrigeration and Air Conditioning," G. F. Taubeneck, "Air Conditioning and

frigeration News." A typical modern frigerator has at least 100 plastic parts. th nearly twice as many parts being used a few deluxe models. Designers are eaming of an all-plastic, self-insulating astic cabinet. Realization of this dream ill depend on the technical data on plas- s that can be furnished by manufacturers.

"Communications," W. O. Baker, Bell elephone Laboratories, Inc. Plastics have en found ideal as electric insulating ma- rials. The problem, here, is obtaining fficient technical data on plastics for ssible use in computers and other elec- onic communications equipment.

utomotive Session

"Plastics Automotive Components," A. J. arter, Chrysler Corp. Today, approxi- ately 250 plastic parts are used in the verage automobile. This usage is expected o increase as designers seek more efficient aterials to improve performance and conomy. New plastic polymers and com- ounds will be used after proper evaluation or specific applications.

"Advances in Body Manufacturing Tech- niques," J. G. Coffin, Chevrolet Division of General Motors Corp. Plastics, espe- cially glass-reinforced plastics, have be- come almost vital to modern automotive programs. As familiarity with plastics in- creases, wider use is expected in the future.

Packing Session

S. W. Jones, Jr., M. W. Kellogg Co., presided over this session at which four talks were given.

"New Developments in Flexible Packag- ing," T. R. Baxter, Continental Can Co. After reviewing recent usages of plastics in flexible packagings, the speaker pre- dicted a growing contribution by plastics in the future.

"New Developments in Rigid Packag- ing," Lloyd Stouffer, "Modern Packaging." A review of recent developments in rigid packages. The future of plastics in this field will depend on continued reduction of costs.

"A Review of Vacuum Formed Visual Packages," E. B. Stratton, Jr., Auto-Vac Co. Price reduction of materials will result in a headlong rush to visual packages.

"Progress Report on F.D.A. Legislation," Elliot Balestier, Jr., Visking Corp. Report on a recent bill requiring that proof be submitted to the Food and Drug Administration prior to use of any chemical used in food packaging materials.

Building Materials Session

David Guarnaccia, Monsanto Chemical Co., presided over this session, at which three talks were given and the presentation of awards to winners of the SPI Plastics House Competition.

"Plastics in Building Today," A. G. H. Dietz, Massachusetts Institute of Technology. Currently, plastics are used in appreciable quantities in building for a wide variety of applications. Their increasing use depends on an understanding of their properties and limitations.

"Regulation of the Use of Plastics in Building," F. J. Rarig, Rohm & Haas Co. Although there are relatively few adoptions of building code amendments explicitly providing for use of plastics in building, the industry has obtained numerous temporary approvals for use in exterior wall panels, interior partitions, roof panels and skylights, luminous ceilings, sidewall glazing, interior trim and finish, and others. The SPI and MCA have been working for four years to develop a sound set of regulations.

"Plastics Tomorrow in Building," R. F. Smith, architect. Plastics may fulfill the architects' dream of new, light, colorful, durable, strong building materials. Plastics will expand from their present spotty use to integrated buildings made wholly of plastics.

Winners in the Plastics House Competition were announced by P. A. Belk, Hercules Powder Co. and chairman of the Society's public relations committee. Prize-winners were named in the 13 categories ranging from overall design for small homes to designs for feature living spaces. Grand prize winner in the "Best Houses" category was William Goodwin, and second and third prizes went to Hermes & Colucci and John Dyal, respectively. The awards for the best feature areas were as follows: porch or outdoor living area, Hermes & Colucci; bath or dressing room K. E. Coleman; and playroom, R. B. Frazier.

SPI Annual Meeting

Norman Anderson, General Molded Products, Inc., and SPI president, presided over the Society's annual meeting. N. J. Rakas, National Automotive Fibres, Inc., presented a report on SPI engineering and technical activities.

All current SPI officers and directors, except as noted below, were reelected. The new directors are: Midwest Section, W. D. McKay, Keolyn Plastics, Inc.; Pacific Coast Section, J. C. Prior, Sierra Electric Corp.; Button Division—Arthur Rosenthal, Rochester Button Co.; Engineering and Technical Division, Kenneth Perkins, Diehl Mfg. Co.; Film and Sheeting Division, K. L. Edgar, Firestone Plastics Co.; Machinery Division, A. A. Hutchings, F. J. Stokes Corp.; Mold Makers Division, Islyn Thomas, Newark Die Co.; Molder Management Division, N. H. Porte, General American Transportation Corp.; Reinforced Plastics Division, C. E. Bacon, Owens-Corning Fiberglas Corp.; and director-at-large, C. B. Branch, Dow Chemical Co.

J. H. Heckman, Dow, Lohnes & Albertson, spoke on the status of F.C.C.'s proposed changes in rules and regulations covering the use of high-frequency equipment for molding and heat sealing.

Communications Session

Four papers were presented at this session, with G. H. Reed, American Hard Rubber Co., presiding.

"Trends in Extrusion Materials for Communications Wire and Cable," J. B. Howard and V. T. Wallder, Bell Telephone Labs. Vinyl polymers and copolymers and polyethylene are the chief materials used for covering wire and cable. Since identification colors must be distinguishable after long service, better colorants are needed for polyethylene insulation. Foams and polyolefins are expected to find wide use as wire insulations.

"Encapsulation and Miniaturization," W. R. Cuming, Emerson & Cuming, Inc. While plastics have been used in commercial electronic applications for some time, military applications will require materials of improved temperature and performance capabilities. As such, encapsulation is ruled out in many military electronic systems because of the heat problem.

"A Molded Flush Circuit Process," R. M. Bell, International Business Machines Corp. Description of a new process for making a printed type conductor that is flush with the insulation backing. Virtually any of the molding materials may be used in this process.

"Plastics in Telephone Instruments," G. A. Wahl, Bell Telephone Labs. Black handsets are still made of phenolic, but butyrate is being used for all housings and for colored handsets. Some 15 plastics are new being used in telephones, and half of the phones being made now are in colors.

Refrigeration and Air Conditioning Session

Islyn Thomas, Newark Die Co., presided over this session, at which the following three papers were presented:

"Sheet Forming and Extrusion," D. A. Davis, General Electric Co. An installation was described in which a group of extruders feed sheet stock to a number of special forming machines for production of inner door liners and other refrigerator components.

"Moldings," R. V. Johnson, Admiral Corp.'s Midwest Mfg. Corp. subsidiary. Some 27 pounds of molded plastic parts are being incorporated in some of the firm's deluxe refrigerators, not including the plastic inner door liner. Plastics are rapidly becoming indispensable in the refrigeration industry.

"Plastic Foams as Refrigerator Insulation," O. H. Yoxsimer, Westinghouse Electric Corp. The industry is working on super-thin walled designs that are expected to fully utilize plastic foams as insulations for refrigerators.

Luncheon Session

The luncheon session on June 14 featured

a talk, **"A Behind-The-Counter View of Plastics,"** by P. M. Talbott, National Retail Dry Goods Association. W. J. A. Connor, American Plastics Corp., presided over this luncheon.

In his remarks, Mr. Talbott noted that consumer acceptance of plastics depends on good design of products, good color, effective performance, brand names, and the use of informative labeling.

Molders' Management Meeting

N. H. Porte, General American Transportation Corp., presided over the meeting of SPI's Molders' Management Division, of which he is the new general chairman. Following a talk on **"Sound Costing Practice,"** by Frank Wallace, Peat, Marwick, Mitchell & Co., five committee reports were presented, as follows: labor relations, K. R. Mergen, Crest Molded Products, Inc.; supplier relations, H. C. Haaxma, Wolverine Plastics, Inc.; Insurance on molds, R. L. Davidson, Kurz-Kasch, Inc.; sales department policies, W. R. Hopkins, Shaw Insulator Co.; and set-up and color changes, E. R. Keown, Santay Corp.

There was a discussion of the Operating and Financial Ratio Report for molders and extruders which was issued in 1954, and covered earnings for 1953. The attendance strongly urged that the report be brought up-to-date. This will be done after results of a revised questionnaire are tabulated.

Reinforced Group, SPE N. Y.

"Approaches to Molding Complex Parts" was the problem under discussion at the May 23 meeting of the Reinforced Plastics Group, New York Section of The Society of Plastics Engineers, Inc. Approximately 40 members and guests attended the meeting, which was held at the Gotham Hotel in New York City.

Melvin Rubin, Steiner Plastics, discussed "Toy Car Body Manufacture," covering the problems encountered in making the Ford Thunderbird, Jr. Ford furnished the original prototype, and Steiner has produced 2,500 units of the toy replica in the past two years. Basic considerations were as follows: should the item be molded in one piece or as several units; what material should be used; and what manufacturing method should be employed? The model car was molded of reinforced plastic materials by the air-diaphragm method, using 12 psi. pressure for 1½ hours. Because of complex undercuts, a split mold was necessary; however, as many as 60 units were produced per week.

"Molding Complex Parts by Means of Contact Pressure" was the subject of a talk by Irving Einhorn, Budd Co. The specific item under discussion was a metal rail car with a reinforced-plastic interior. The problem involved the proper choice of resin-catalyst system. The materials were always checked in the mixing room for proper cure, contamination, viscosity, and color. For the latter, Budd found Du Pont's colormeter or colorimeter to be most effective in color matching, particularly when long intervals elapsed between runs.

Celanese Corp. of America's Michael Kallaur spoke on "Processes & Methods of Molding Complex Shapes from Premix Compounds," particularly with respect to getting reinforcements to follow complex curves. Material is cut to fill the contours, and a spray gun is used. Pre-mix compounds are reported to be especially useful in the automotive field due to the cost differential. Lay-up methods are not required, thereby eliminating the necessity for frequent hand-washings. Flexibility is another important consideration.

Frank Sheffler, Lunn Laminates, Inc., covered various methods of "Estimating Material and Labor Costs on Complex Parts." Essential differences in methods for estimating on simple parts include the methods of obtaining physical dimensions, systems for calculating material waste allowances, increased labor requirements, greater handling problems, and the faster labor-learning rate required to attain maximum production.

SPE-SPI New England

A panel discussion on "Future Markets for Plastics" highlighted the May 17 joint dinner meeting of the SPE Eastern New England Section and the SPI Boston-Providence Chapter. Approximately 150 members and guests attended the meeting, held at the Andover Country Club, Andover, Mass. George P. Kovach, Foster Grant Co., acted as moderator of the discussion, and the panel members were John F. Murphy, Monsanto Chemical Co.; Professor A. G. H. Dietz, Massachusetts Institute of Technology; Leroy A. Darling, Sperry Gyroscope Co.; and Robert Lowry, Cryovac Div., Dewey & Almy Chemical Co.

Mr. Murphy, the first speaker, discussed "Plastics for Agriculture," with emphasis on films and sheetings. Typical applications covered included silo covers, soil fumigation covers, greenhouse sunlight-control sheetings, and mulching uses. In these applications, plastics offer added protection to crops, improvements in working conditions, and reduced costs. Vinyls require special plasticizers to resist silage acids, ultra-violet exposure, weathering, and low temperatures.

Prof. Dietz spoke on the present and future applications of plastics in building. The largest single use of plastics in building is in non-structural applications such as flooring and wall coverings. Using slides to illustrate his talk, the speaker described such uses as insulating foams, vapor-barrier films, wall structures of stressed skins with honeycomb cores, and others. The two major problems hampering the utilization of plastics in building are flammability and toxicity during burning; however, both the Los Angeles and San Francisco building codes allow use of plastics under specified conditions.

Mr. Darling, the third speaker, discussed the utilization of thermoset resins in the design and application of electronic components. Polyester resins have replaced the hot-melt wax and resin materials for potting these components. In such applications, the polyesters provide very good electronic properties and can be modified to obtain specified mechanical and electrical properties. Epoxy resins have replaced polyesters where high strength and resistance to severe temperatures are required. The speaker concluded with a detailed description of the process for embedding electronic components in plastic, stressing the need for liaison between designer and plastics engineer in the design of embedded circuits.

The final speaker, Mr. Lowry, covered packaging materials for food, drugs, cosmetics, and metallic parts. The three basic requirements for any packaging job are protection, appearance, and convenience, regardless of whether the package is a wrapped or heat-sealed film or sheeting, bottle, tube, aerosol bomb, or capsule. In conclusion, the speaker discussed the time and cost required to have a new packaging material approved by the government's Food and Drugs Department.

The meeting closed with a showing of the sound-color film, "Pipe Lines to the Future," by Republic Steel Corp., on the various uses of plastic pipe in industry, on the farm, and in the home.

SPE New York Section

SPE's New York Section featured a two-part program at its June 20 meeting. The Gotham Hotel in New York City was the site, and approximately 70 members and guests were in attendance.

A film entitled "Color Dynamics in Industry" was shown by A. Cerniglio, Pittsburgh Plate Glass Co., following a few introductory remarks. The film demonstrated the effects of color and combinations of color on the human eye, and how the proper use of color in a plant reduces eye-strain and absenteeism. According to established codes, certain colors are used to indicate fire apparatus, disposal and refuse areas, dangerous chemicals and duct systems.

"Factors Affecting the Properties of Polyethylene" were pointed out by Richard H. Hardesty, E. I. du Pont de Nemours & Co., Inc., particularly with reference to fundamental molecular characteristics. The five most important factors were presented as follows: Weight-average molecular weight; number-average molecular weight; molecular weight distribution; number of short-chain branches; and the long-chain branching index. The various properties of polyethylene were defined, including stiffness, yield strength, tensile strength, tear strength, permeability, processibility, film brittleness, low-temperature brittleness, Vicat softening temperature, flex life, creep, and environmental stress-cracking; and it was brought out how these properties are affected by the aforementioned molecular characteristics.

(Continued on page 485)

NEWS of the INDUSTRY

National Plastics Exposition Sets New Records

Entrance to National Plastics Exposition at New York Coliseum has molded Tenite butyrate letters over marquee.

New records in attendance and exhibit space were set at the Seventh National Plastics Exposition, sponsored by the Society of the Plastics Industry, Inc., and held at the New York Coliseum on June 11-15. Some 36,700 individuals from all branches of business, industry, and government visited the show. This attendance far exceeded the expected turn-out of 20,000, and was more than double that of the last Exposition, held in Cleveland. O., in 1954. Attendance at that show totaled 14,171 industry visitors. As in the past, the Exposition was not open to the general public.

More than 330 exhibits prepared by 235 companies occupied two floors of the Coliseum, covering some 70,000 square feet of exhibit space. This is an increase of almost 25% over the 1954 show, and almost 120% over the space occupied in 1948 at the Grand Central Palace, the last time the show was in New York. The City did its part by designating the week of the Exposition as "Plastics Week," and Columbus Circle (the site of the Coliseum) was officially renamed "Plastics Circle" during that week.

Exhibitors expressed great satisfaction with this year's show which covered all branches of the plastics industry, including molders, fabricators, material suppliers, moldmakers, machinery suppliers, instrument manufacturers, laboratories, service organizations, and others. Exhibitors were particularly pleased with the attendance, which represented all types of occupations and industries, and the large volume of business expected to result from inquiries and tentative orders received from the visitors.

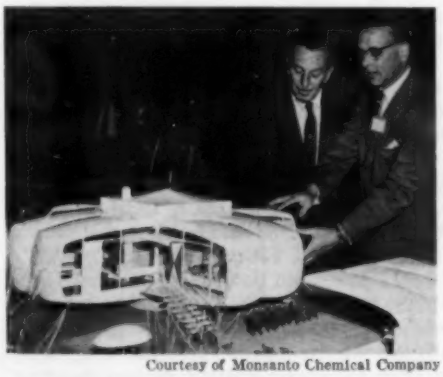
At the official opening of the Exposition on June 11, Norman Anderson, General Molded Products Co. and 1956 president of SPI, predicted that gross sales for the plastics industry this year will exceed $2-billion, while plastics production should reach a total of four-billion pounds this year, making 1956 a record year for the industry. This growth picture holds true for both thermoplastic and thermosetting materials.

Mr. Anderson predicted that polyester resin production for reinforced plastics would increase 50% over the 49-million pound total of 1955. Vinyl resin output this year is expected to surpass the 1955 level, while polyethylene production this year promises to be 50% higher than last year's total of 420,191,117 pounds. All other plastic materials continue to show marked evidence of growth, Mr. Anderson noted.

Exhibit Highlights

Any review of the Exposition exhibits cannot do more than touch on some of the highlights, since almost each of the 330 exhibits featured one or more new items, whether raw materials, molding materials, products, equipment, instruments, etc. These new items will be described more fully in individual stories that will be published in the appropriate departments of our subsequent issues.

The American Cyanamid Co. display featured new decorative effects in melamine dinnerware; two new thermoplastic molding compounds; and a do-it-yourself method of building a patio roof with glass-reinforced polyester corrugated panels. Bakelite Co. displayed a new bulk-handling system for molding resins; encapsulating resins; low-pressure molding of reinforced plastics; new light-colored paints for phenolics;



Courtesy of Monsanto Chemical Company

R. K. Mueller, Monsanto vice president (left), and Walt Disney examine scale model of Monsanto's "House of Tomorrow" at Exposition.

Largest one-piece molding at Exposition was "Frigid-Van" body exhibited by Celanese. Truck body was molded by Heil Co. of reinforced Celanese polyester resin.

and demonstrations of skin-packaging, plastic tool making, molten bead sealing, and phenolic foam blowing.

Carbide & Carbon Chemicals Co. exhibited its plasticizers, monomers, and intermediates, including a new monomer for making rigid or semi-rigid vinyl products by the plastisol technique. Highlights of the Celanese Corp. of America exhibit of its molding materials were its new polyolefin thermoplastic material, and a one-piece molded body for a refrigerated truck made by Heil Co. of reinforced Celanese polyester resin.

New items featured in the Dow Chemical Co. display were four modified polystyrene formulations, an improved saran monofilament resin, an expected new family of styrene-acrylonitrile thermoplastics, and a new ethyl cellulose compound. The exhibit by E. I. du Pont de Nemours & Co. featured a closed-circuit television program, "Customers' Showcase," where 38 makers of products using the company's resins were interviewed, and the products displayed. Incidentally, this program drew much sympathy from visitors for the people forced to undergo the hot, bright lights needed for television.

Two new formulations highlighted General Electric Co.'s exhibit of its line of phenolic molding compounds. Nearly 100 practical applications of vinyl plastics were shown by B. F. Goodrich Chemical Co. in their "House of Today," a full-scale cutaway showing a living room, kitchen, utility room, patio, and section of the "house next door." A scale model of the "House of Tomorrow" was featured in the Monsanto Chemical Co. exhibit; this house will demonstrate and test the uses of plastics in home construction, and the first house will be built early next year in the Tomorrowland area of Disneyland, Anaheim, Calif.

Polymer Corp. showed the latest developments in the field of industrial plastics, and demonstrated its Whirlclad process for coating metals and other materials with nylon, polyethylene, and other plastics. Acrylic lighting panels and fixtures for home, outdoor, and industrial uses were displayed by Rohm & Haas Co.

The displays by equipment manufacturers received particular attention at the Exposition, since most of the firms had at least one machine in actual operation and were distributing the items being produced as samples. To be noted among the equipment displays were a new cavity steel for plastic molds and cast dies, by

Detroit Mold Engineering Co.; the precision extruders of National Rubber Machinery Co.; the high-output extruders, complete with fully automatic temperature control cabinet, shown by Prodex Corp.; the new two-ounce automatic injection machine shown by F. J. Stokes Corp.; and the automatic process control units, employing beta-ray gages, of Tracerlab, Inc.

Of the exhibits, 53 were by companies in the processing field, including such operations as molding, extrusion, calendering, casting, decorating, finishing, assembly, etc. These displays provided much of the color at the Exposition, and the products shown ranged from novelties, toys, and housewares to industrial items and components. In this group of exhibitors, special mention must be made of the new Anchorene modified-styrene tracks extruded by Anchor Plastics Co.; the new Star utility car of reinforced plastic shown by Bassons Industries Corp.; and the display by Chicago Molded Products Corp. which featured extruded linear polyethylene sheet, a new laminated plastic construction panel, and extruded styrene copolymer sheet.

Columbian Carbon Builds Labs

Construction is presently under way on Columbian Carbon Co.'s new office and laboratory center in Monroe, La. Three buildings, connected by covered walkways, will house operating headquarters for the firm's carbon black manufacturing operations in that area, engineering department, the chemical laboratory, and the rubber laboratory.

The buildings will have a total floor area of 25,000 square feet, and will represent an investment in excess of $350,000. Completion is scheduled for this October.

98-Mile Plastic Pipe Line

A 98-mile plastic pipe line, believed to be the longest of its kind in the country, has been installed in the Castro and Swisher Counties of west Texas to carry fuel to 200 irrigation pumps. The plastic line, buried three feet deep, cuts across fields and runs along fence lines in a series of branches, ranging up to 15 miles in length, which link the pumps with a main pipe line carrying natural gas used to power the pumps.

Made from Kralastic acrylonitrile copolymer blend produced by Naugatuck Chemical Division, United States Rubber Co., the pipe was formed into 30-foot lengths, mostly two inches in diameter, by Republic Steel Co. for the line. Installation of the pipe took 31 working days, with the job being speeded up by using cemented and solvent-welded joints. Dimmitt Ditching Service did the installing, using two mechanical ditch diggers to cut trenches for the line; a small crew to lay the pipe; and a road-grading "maintainer" to fill in the ditches behind the pipe-laying crew.

Plastics Prove Life-Savers

Plastic has been credited with saving the lives of two men who crashed their plane head-on into a mountainside. Both pilot and passenger walked away completely unharmed after their Taylorcraft crashed into trees at the top of Blue Mountain, 60 miles east of Harrisburg, Pa., because of bad weather and zero visibility. Their plane had fuselage and wings made of reinforced Polylite polyester plastic, a product of Reichhold Chemicals, Inc.

At the time of the crash, the plane was flying at cruising speed. Ordinarily, neither man would have had a chance to survive such a crash, according to the investigating officials. However, the strength and energy-absorbing qualities of the reinforced plastic were so great that the cabin section of the fuselage was not even twisted out of shape. Even the gas tanks, also made of reinforced Polylite, did not break or leak, thus eliminating the fire hazard attending most plane crashes.

Both pilot and passenger of this Taylorcraft plane, made with reinforced plastic fuselage, wings, and gas tanks, were unharmed after crash into mountainside.

Dow Streamlines Tech Service

A streamlining of its plastics technical service group has been announced by Dow Chemical Co., Midland, Mich., to provide improved customer service and more effective product development work. F. J. MacRae has been appointed assistant manager of the entire PTS group. He formerly served as an assistant manager, sharing responsibilities with E. L. Kropscott who recently transferred to the plastics department administrative staff.

Directly responsible to Mr. MacRae are R. J. McDonald, office and supplies manager, and the managers of the three field sections: E. E. Merrill, PTS-East, with headquarters at the Allyn's Point, Conn., division; L. E. Tallman, PTS-West, headquartered in Los Angeles, Calif.; and R. W. VanSickle, PTS-South, located at Dow's Texas division, Freeport.

PTS-Midland has been divided into three basic groups, each under its own manager: fabricated products group, including film, expanded plastics, and sheet, headed by E. E. Ziegler, former head of the testing section; molding materials, including molding, extrusion, and engineering and mechanical development, headed by G. W. Cheney, former extrusion section head; and testing and evaluation, headed by P. H. Lipke, former head of the formulation section.

In the molding materials group, R. E. Monica, former head of the calendering section, is in charge of the extrusion section, succeeding Mr. Cheney. The work of this section will include calendering. The molding section continues under the leadership of Gordon B. Thayer, and the new engineering and mechanical development section is headed by D. B. Semeyn, former development engineer on the heat fabrication staff.

In the testing and evaluation group, H. W. Wehr heads the formulation section and J. A. Struthers heads the newly-created special products development section. Both Messrs. Wehr and Struthers were formerly in the molding section.

Forms International Company

Koppers Co., Inc., Pittsburgh, Pa., has announced the formation of Koppers International, C. A., to handle all foreign activities including product sales, and overseas plant operations. Fred C. Foy, president of Koppers, will also serve as president of the new firm, and George W. Naylor has been elected vice president and general manager. Mr. Naylor also becomes a vice president of the parent firm.

Previously, Koppers' foreign activities including engineering services and technical contracts were handled by one or more of the company's six divisions. Establishment of the new firm will coordinate all of these activities into one.

Claremont Opens Suburban Plant

A new plant with double the previous capacity has been opened by Claremont Pigment Dispersion Corp., at 39 Powerhouse Road, Roslyn Heights, L. I., N. Y. Manufacturer of dispersed colors for plastics, Claremont rapidly outgrew the Brooklyn plant, and elected to move to an area with more modern facilities and better transportation.

The Roslyn unit is a long, one-story building designed for a single flow of production from raw materials to finished products. Included are 30,000 square feet of floor space, a railroad siding, and off-street truck platforms.

Haveg Industries Expands

Centralized manufacture of reinforced polyester ducts and tanks through the acquisition of a new plant in West Warren, Mass., has been announced by Haveg Industries, Inc., Wilmington, Del. Another expansion move involves the creation of a new marine department at 101 Central Ave., Westfield, N. J., which will merchandise Haveg's expanding production of reinforced-plastic marine products including Havegcraft, a line of fibrous glass-reinforced polyester outboard boats. They will also be molded at West Warren.

To Expand Plaskon Output

Plans for substantial expansion of its production of Plaskon polyester and liquid phenolic resins at its Toledo, O., plant have been announced by Barrett Division, Allied Chemical & Dye Corp., New York, N. Y. Plans call for more than doubling polyester resin capacity, and nearly quadrupling phenolic resin output. The new facilities will come into operation by stages, with final completion scheduled for mid-1957.

To Enlarge Silicone Plant

The acquisition of more than 60 acres of land adjacent to the Silicone Products Department of General Electric Co., Waterford, N. Y., has been announced by C. E. Reed, general manager of the department. Bringing the over-all plant site to more than 160 acres, the new acquisition provides adequate space for a planned expansion of production, research, and administrative facilities to meet the increasing demand for silicones.

The Waterford plant is a completely integrated silicone production unit making basic chemical intermediates and silicone gums, rubbers, resins, emulsions, and specialties. Plant capacity has been increased several times since production first began in 1947.

Doubles Acrylic Paint Sales

The year 1955 saw not only a doubled sales volume for acrylic paints, but also a doubling in the number of companies manufacturing them. Acrylic latex was first placed on the market by Rohm & Haas Co., Philadelphia, Pa., and has already become one of the "big three" in the rapidly-growing water-vehicle paint industry. Over 300 companies now produce acrylic paints.

Open Sales Offices

Six district offices for its plastics sales division have been opened by Phillips Chemical Co., Bartlesville, Okla., preparatory to full-scale marketing of the company's new family of Marlex polyethylenes. The offices and their managers are: Elmhurst (Chicago), Ill.—J. T. Roach; Pasadena, Calif. (Western district)—T. G. Askew; New York, N. Y.—W. C. Douce; Akron, O.—W. M. Larsen; Providence, R. I. (New England district)—C. R. Scott; and Bartlesville, Okla. (southern district and foreign sales)—R. F. Uber, George Wash and W. R. Clark are sales manager and assistant sales manager, respectively, for the sales division.

A sales service laboratory is under construction at the Phillips Research Center, and commercial production of Marlex will begin this fall at the 110-million pounds per year plant now being built.

Carlisle Completes Facilities

Completion of greatly-expanded research and general office facilities has been announced by Carlisle Chemical Works, Inc., Reading, O. Added space approximates 17,000 square feet, bringing the total footage to 24,800.

The exterior structure is of glass block, brick, and aluminum, and the interior is faced in tile. Another feature is the underground bomb shelter, complete with operational facilities for a sustained period of time. Completely modern in design, the laboratories are air conditioned and equipped for temperature-sensitivity testing.

Enters Plastic Pipe Field

One of the country's leading manufacturers of electrical fiber conduit and bituminized-fiber sewer pipe, Orangeburg Mfg. Co., Inc., of Orangeburg, N. Y., and Newark, Calif., expects completion of its plastic pipe plant by July, 1956. Presently under construction at Orangeburg, the new unit marks the firm's entry into the plastics field.

Distribution will be accomplished through the company's existing outlets, and will not compete with present products. The move is in line with Orangeburg's plans to diversify operations, and is the immediate result of a number of years' research and pilot plant operations.

Wilmod Forms New Division

The formation of a new rubber division, to carry both rubber and plastics equipment, has been announced by Wilmod Co., plastics division, Toronto, Ont. The new division will operate both in Canada and the United States, and will carry a full range of light, medium, and heavy rubber and plastics equipment supplied by Iddon Brothers, Ltd., of England. John Williams will head the division as technical sales and service manager. He was formerly with Francis Shaw (Canada), Ltd., and Francis Shaw & Co., Ltd.

Completes Plant Expansion

The completion of a plant expansion program, involving the addition of over 7,000 square feet of plant, office, and research laboratory space, has been announced by Logo, Inc., Chicago, Ill. A new, 3,500-square foot building has been erected and equipped at the plant site for use as a paint blending room. Offices and research laboratories, formerly located at the plant site, have been moved to the Calumet Harbor Terminal Bldg., Chicago. Tank farm facilities for bulk handling of solvents, resins, and intermediate products have been increased more than 10%. The new facilities have more than tripled the company's capacity for research activities on conventional and vacuum metallized coatings in the fields of plastics, metals, and papers.

New Name for F. J. Stokes

Effective July 1, the F. J. Stokes Machine Co., Philadelphia, Pa., changed its name to F. J. Stokes Corp. The new name was selected as being more in keeping with the broad range of the company's interests, and the varied line of production and processing equipment which it has developed during its 60 years of growth.

The firm was founded in 1895 as a manufacturer of hand-operated pharmaceutical tabletting presses; the forerunners of current fully automatic tabletting presses. About 1920, Stokes developed the first of what is now a large line of powder metal compacting presses. The company's work in the drug manufacturing industry resulted in the development of a line of dryers, mixers, drug mills, and granulators. From here, it was a logical step to the development of vacuum drying equipment for the process industries. Vacuum processing equipment has become an increasingly important area of activity for the firm.

To Broaden Polyethylene Work

Plans to broaden its work in the field of high-density, low-pressure polyethylene plastics have been announced by Texas Eastman Co., division of Eastman Kodak Co., Rochester, N. Y. According to James C. White, president of Texas Eastman, construction of a semi-commercial manufacturing unit at the Longview, Tex., plant will begin promptly. This new unit will be "modest" in size, and will be used for experimental production which may result in eventual commercialization of a process developed by Standard Oil Co., Indiana, and licensed to Eastman Kodak.

Texas Eastman was established at Longview in 1950, to produce industrial chemicals for propane and natural gas. A 20-million-pound polyethylene unit was added in 1954, and an announcement that the capacity of this unit would be doubled was made earlier this year.

Builds Polyethylene Units

Construction of two new plants for the production of low-pressure polyethylene has been announced by Union Carbide & Carbon Corp., New York, N. Y. Located at Institute, W. Va., and Seadrift, Tex., the plants will have a combined rated annual capacity of 55-million pounds. The Institute unit is scheduled for completion in the first quarter of 1957, and the Seadrift unit will be in production a few months later.

The new facilities will be equipped to produce polyethylene by a number of techniques, using not only the Ziegler and Phillips low-pressure processes (for both of which Union Carbide has been licensed), but also incorporating advanced technical improvements in olefin polymerization developed in Carbide's laboratories and pilot plants.

The new facilities are being built and will be operated by Carbide & Carbon Chemicals Co., while Bakelite Co. will handle sales of the materials produced.

New Process for Continuous Sealing of Polyethylene Film

Continuous sealing of polyethylene film at rates of 500 feet per minute or higher is made possible by a new molten bead sealing principle developed by Bakelite Co., New York, N. Y. Scientists at the company's Packaging Laboratory, Bound Brook, N. J., came up with the idea of feeding a continuous bead of molten polyethylene resin between layers of film to fuse them together at high speeds.

Conventional methods that seal 10-mil film at a maximum rate of 25 feet per minute, and 1½-mil film at 150 feet per minute, apply heat from the outside. The new principle extrudes a hot filament of polyethylene between two layers of film at the point where they are to be sealed. The first bead sealer developed at the Laboratory employs an extruder with a ¾-inch diameter bore and 1/16-inch diameter die opening to produce the continuous molten bead. Bakelite polyethylene resin is heated in the extruder to about 250° C. and forced out at the rate of about 1½ pounds per hour. The molten bead is fed between continuously moving lengths of film travelling at speeds of 500 feet per minute or more. Just enough pressure to flatten out the molten bead between the two films is applied to rollers through which the film passes after picking up the bead.

The new technique may be used to seal polyethylene film of almost any thickness, and is applicable to the sealing of polyethylene laminates and coated papers. Bakelite has applied for a patent on the process, and commercial applications are being sought, but equipment for molten bead sealing is not yet commercially available.

To Increase Alathon Output

An expansion program that will virtually double its capacity for manufacturing Alathon polyethylene resin has been announced by the polychemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Plans include the modernization of existing facilities and the construction of a new manufacturing unit at the company's Sabine River Works, Orange, Tex. This new unit is scheduled for completion early in 1958. The modernization progrem includes expansion of existing facilities in the Sabine plant to permit periodic increases in production. The first such increase is expected to be complete by late summer.

A substantial part of the new production will be in the two higher-density resins, Alathons 34 and 37, which were first made available last March. All of the increased production will be in the field of conventional polyethylenes of intermediate density, ranging up through the 0.930 density of Alathons 34 and 37, and does not include the higher density linear polyethylene now under development by Du Pont. Pilot-plant testing of the linear polyethylene is proceeding at the Sabine plant, and plans for this resin will be announced at a later date.

In Brief . . .

New Jersey Zinc Co. and **American Cyanamid Co.,** both of New York, N. Y., jointly announced the carrying out of a sales agreement first made in March 1954. Under this agreement, Cyanamid's Gloucester City, N. J., titanium dioxide pigments plant was turned over to N. J. Zinc, following completion of Cyanamid's new plant at Savannah, Ga.

General Tire & Rubber Co.'s Jeanette division, Jeanette, Pa., has added four new patterns to the 1956 Boltaflex line of unsupported vinyl coverings. Designated Haiti, Killarney, Meadowbrook, and Colonial, the coverings are reported to be especially suited for hassocks and cardtable sets.

Ferro Chemical Co., Cleveland, O., has announced the approval by the U. S. Food & Drug Administration of its two new nontoxic stabilizers, 707X and 760X. These materials are reportedly the first non-toxic, high-temperature resistant stabilizers to be cleared for use in vinyl food-wrapping.

The Dobeckmun Co., Cleveland, O., has been licensed to conduct operations under patents owned by National Research Corp. and relating to continuous vacuum metallizing. Under terms of the agreement, Dobeckmun has full access to future developments and patents.

E. I. du Pont de Nemours & Co., Wilmington, Del., announced that its Experimental Station's more than 1,200 employees have set a new world's record for safety in chemical laboratory operation—more than 7,300,000 man-hours without a time-losing injury. The new record beat the Station's previous safety mark set a few years ago, and encompasses more than three years of operation.

National Rubber Machinery Co.'s plastics machinery division, Akron, O., has appointed the F. F. Barber Machinery Co., Ltd., Toronto, Ont., to handle sales and engineering service on NRM thermoplastics extruders and equipment in Canada. Barber handles a number of lines for U. S. machinery manufacturers.

Bakelite Co., New York, N. Y., demonstrated the making of epoxy tooling at the American Society of Tool Engineers' Industrial Exposition, which was held in Chicago on March 19-23. The demonstration was carried out by personnel of Ren Plastics, Inc., a producer of tooling compounds based on Bakelite epoxy resin, and featured the actual production of a master Keller model of an automobile door locking pillar.

Dow Chemical Co., Midland, Mich., has redesigned its Styron containers, adopting the standardized blue ink and label characteristic of other Dow products. Items affected by the change are the 50-pound bags, the 200-pound fiber drums, and the 1,000-pound bulk boxes.

Goodyear Tire & Rubber Co., Akron, O., has appointed the following distributors for its rubber and vinyl flooring products: Georgia Metal Moulding Co., Atlanta, Ga.; Armstein Carpet Co., San Francisco, Calif.; Hill Corp., San Francisco, Calif.; Empire Distributing Co., Salt Lake City, Utah; and I. J. Saks & Co., Los Angeles, Calif.

American Cyanamid Co., New York, N. Y., announced a price reduction of three cents per pound for melamine, effective May 1. The new melamine prices are 36¢ per pound for carload or truckload quantities, and 31¢ per pound for lesser quantities. The reduction was said to have been made possible by process improvements and operating economies.

Chas. Pfizer & Co., Inc., Brooklyn, N. Y., has announced a reduction in the price of purified itaconic acid to 54¢ per pound, simultaneously revealing the development of a technical grade compound which will be priced at 45¢ per pound.

Marblette Corp., Long Island City, New York, N. Y., has named Precision Tool Sales, 417 East Florence Ave., Los Angeles, Calif., as its Western representative. This appointment is part of an over-all plan to expand services and technical assistance in that area.

General Coating Co., Woodbridge, N. J., has been appointed a franchised applicator of Unichrome 5300 series sprayable plastisols made by Metal & Thermit Corp., New York, N. Y. General has had more than 10 years of experience in coating equipment such as tanks, fans, piping, and filter press plates.

Goodyear Aircraft Corp., Akron, O., is turning out door arm rest panel sets for the Ford Motor Co.'s Continental Mark II car. Made from reinforced plastic premix compounds, the panels are formed in 300-ton presses by Goodyear's laminates division.

Colton Chemical Co., division of Air Reduction Co., Inc., has moved to new and larger quarters at 1747 Chester Ave., Cleveland, O. The firm was formerly located at 1545 East 18th St., also in Cleveland.

News from Abroad

Announces Rigid Polyethylene

A high-density, stiff polyethylene called Alathene HD has been introduced by Imperial Chemical Industries, Ltd., England. Pilot-plant quantities should be available shortly through Canadian Industries, Ltd., Montreal, Que. Processable by conventional methods, the new material features high-temperature resistance, and manufactured parts can be sterilized.

French Polyethylene Plant

Plans for building a commercial plant for the production of low-pressure polyethylenes have been announced by Societe des Usines Chimiques Rhone-Poulenc, Paris, France; Establissements Kuhlmann, also of Paris; and Compagnie Francaise de Raffinage (C.F.R.). These companies will work together under a license recently granted to Rhone-Poulenc by Phillips Petroleum Co., Bartlesville, Okla., for the exclusive use in France of the Phillips process for making rigid or low-pressure polyethylene.

The new plant will be located on a site adjacent to the C.F.R. Gonfreville refinery, near Le Havre. The refinery will supply feedstocks for the ethylene production.

Expansion Plans of Solvic

When the program now under way for expansion of existing plant and the erection of new factories in six different countries is completed, Solvic S. A., Brussels, Belgium, will have a total capacity of more than 55,000 tons of PVC annually, making it one of the world's leading manufacturers of this plastic.

The Solvic concern, which started its first PVC factory at Jemeppe-sur-Sambre, Belgium, in 1949, produces various types of emulsion and suspension polymers, in addition to vinyl chloride-acetate copolymers and PVC compounds. In April 1955, extensions to this factory were started. When completed sometime about the middle of this year, these additions will bring total production capacity here to 15,000 tons annually.

In France, work was begun on additions to the factory at Tavaux (Jura) whereby capacity will be increased to 24,000 tons annually, enabling it to meet France's growing demand for PVC.

The annual capacity of the Ferrara plant of S. A. Solvic, Milan, Italy, was raised to 9,000 tons early in 1955.

Opened in 1953, the PVC factory at Hallein, Austria, operated by Halvic, affiliated with Solvic, proved inadequate to meet the Austrian needs, and is to be extended to provide 3,600 tons annually.

In Torrelavega, Spain, construction is under way on a factory with annual capacity of 2,000 tons which is expected to begin operations this fall.

Elclor, in Brazil, will use the Solvic processes in its plant which was scheduled to open at the end of 1955. Initial annual output has been set at 2,000 tons, but plans envisage an early increase to 4,000 tons.

Methanol Plant for Brazil

A $3.5-million expansion program which will give Brazil its first methanol plant and substantially increase its production of formaldehyde and synthetic resins has been announced by Borden Co., New York, N.Y. Scheduled for completion in 1958, the program will be undertaken immediately by Alba, S.A., a Brazilian chemical company of which Borden International, Ltd. (Borden's wholly-owned Canadian subsidiary), is majority stockholder.

The new chemical plants will be located at Cubatao, Brazil, near the Petrobras oil refineries. Alba, with headquarters in Sao Paulo and a plant at Curitiba, currently produces formaldehyde, plastic materials, and a full line of adhesives. Plans call for the construction of a methanol plant having a daily production capacity of 30 tons, and a formaldehyde and synthetic resin plant which will more than double Alba's current output.

Australian Vacuum Former

Australian plastics manufacturers recently were given the opportunity of seeing a demonstration of the first automatic vacuum forming machine designed and built in Australia.

Scope Laboratories, electronic and electrical engineers of Melbourne, claim to have combined the best features of overseas units with a special heater and automatic timer of their own design in a prototype Model 100 machine. The unit has automatically controlled heating and cooling cycles which, together with automatic heat removal, ensure accurate temperature and molding even with unskilled operators. The 30 by 24-inch molding area is designed to use half-sheets of acetate, rigid vinyl, or the new Australian high-impact styrene sheet. The 100% radiating surface of the heater element ensures even heating, particularly of thin sheets; and there is a choice of two heater widths to permit maximum power economies when using small dies.

Scope's manufacturing program is to have a "100" series of manual and automatically controlled vacuum formers for shallow articles, and a "200" series of manual and automatic controlled drape formers for deep-drawn articles. It is expected that the advertising field, in particular, will use large quantities of vacuum-formed sheet for posters and displays.

Koppers to Help French Firm

Contracts for the engineering design and operating "know-how" of a polystyrene plant have been awarded Koppers International, C. A., by the firm of Huiles, Goudrons et Derives, Paris, France. Under the contracts, Koppers will provide all the engineering plans for the plant, including specifications, detailed flow sheets of the operating processes, and general plant layout. In addition, Koppers will provide the French company with the necessary operating information for the manufacture of polystyrene under processes used at the Koppers' Kobuta, Pa., plant. These processes will be put into practice immediately by Huiles, Goudrons et Derives at an existing plant on the west coast of France. As new developments or improvements are made by Koppers in the future, they will be made available to the French firm.

New Canadian Resin Plant

A new synthetic resin plant will be constructed at Clover Bar, Alberta, according to Monsanto Canada, Ltd., Montreal, Que. This will be Monsanto's third manufacturing plant of this type in Canada, and makes the firm one of Canada's leading producers of synthetic resin.

Emphasis in production at the new plant will be on liquid resin adhesives for the plywood industry of Western Canada. The plant will serve all provinces west of the Great Lakes, except for British Columbia. Ground has already been broken for the plant, and full-scale production is expected this fall.

Sign Exchange Agreement

A five-year agreement has been completed calling for an exchange of information and "know-how" between the Catalin Corp. of America, New York, N. Y., and Adhesivos Resistol, S.A., of Mexico. Specifically, Catalin will disclose to Adhesivos its formulas and technical information pertaining to the manufacture of phenolic, cresylic, resorcinol, melamine, and urea liquid resins for adhesives, textiles, and paper treating. In turn, Adhesivos will supply information to Catalin on any processes developed in these fields.

NAMES in the NEWS

M. E. Schiller

M. E. Schiller has been named operating manager of the films & flooring division, Goodyear Tire & Rubber Co., Akron, O. He joined Goodyear in 1923 as a member of the mailing department; moved into production work in 1925, filling consecutive capacities as production control clerk, dispatcher, and head scheduler; became flooring sales correspondent in 1947; transferred to films, foam and flooring sales in 1949; and was named section head within the films & flooring division in 1950.

J. Kenneth Craver has joined Monsanto Chemical Co., St. Louis, Mo., where he heads up a special applications research program for the company's research and engineering division, Dayton, O. With Monsanto's organic chemicals division from 1938-1953, he has been associated with General Mills, Inc., for the past two years.

James R. Pendry and **Clark Wormer** have joined the sales staff of Fabricon Products Co., River Rouge, Mich. **Mr. Pendry** has been named sales representative and application engineer for the firm's impregnating division, while **Mr. Wormer** will serve in the same capacity for the reinforced Molding division. The former was previously with Eagle-Picher Co., while the latter worked on marketing assignments for the impregnating division of Fabricon.

Walter J. A. Connor has been elected president of American Plastics Corp., New York, N. Y., a subsidiary of Heyden Chemical Corp., to fill the vacancy left by the promotion of **Simon Askin** to chairman of the board. At the same time, **James K. Lindsay,** secretary-treasurer of Heyden, was elected treasurer of American Plastics. Mr. Connor joined the firm as executive vice president in June 1955, after having been senior vice president of Celluplastic Corp. from 1947-1955. Previously, he was associated with U.S. Fiber & Plastics Corp.; Koppers Co., Inc.; and Manufacturers Chemical Corp.

Arthur C. Greber has been appointed director of manufacturing for Clopay Corp., Cincinnati, O. Formerly with Smith, Kline & French Laboratories, **Mr. Greber** has been associated with Procter & Gamble and Schenley Distillers. **Alfred L. Alk** has been promoted from technical director to director of manufacturing for the company's plastic film division, and **James J. Reis, Jr.,** has been named executive assistant to the sales manager of the division.

H. E. Murray has been named technical specialist at the Glendale Plaskon Laboratory, Barrett Division, Allied Chemical & Dye Corp., Toledo, O. He previously served as assistant supervisor, in charge of molding compounds technical service. **James J. Moylan** takes over **Mr. Murray's** former functions, with full responsibility for urea, melamine, and alkyd technical service. **Corwin R. Brandt,** former chief chemist for Cellulose Fibers, Inc., has joined the Barrett research and development staff.

William J. Canavan

William J. Canavan has been appointed manager of Bakelite Co.'s extrusion materials division, New York, N. Y. In his new position, Mr. Canavan will direct the sale of a variety of plastics to wire, cable, and pipe manufacturers.

Edgar H. Bleckwell and **Emil O. Johnson** have been promoted to director of the nylon manufacturing division and production manager for nylon, respectively, for the tetxile fibers department of E. I. du Pont de Nemours & Co., Wilmington, Del. Formerly nylon production manager, **Mr. Bleckwell** succeeds the late **George E. McClellan.**

Charles O. Koch has joined the development department of Mobay Chemical Co., St. Louis, Mo. He is replaced as technical service superintendent at the New Martinsville, W. Va., plant by **Ray M. Ewald.**

Bodie Photographer

Steve Zidek

Steve Zidek has been appointed product manager for the Toy Gloss line of paints by Logo, Inc., Chicago, Ill. Before joining the company, **Mr. Zidek** served as sales manager for fiberglass products with Bee-Lyte Corp., and in an executive capacity for Lever Brothers.

D. W. Thornburg has been promoted to plastics sales engineer in the New York district office, to be established this summer, of Phillips Chemical Co., Bartlesville, Okla. He was formerly process engineer in the refining department of the parent firm, Phillips Petroleum Co., which he joined in 1951.

W. Roberts Wood has been elected president of The Girdler Co., Louisville, Ky., succeeding **George O. Boomer** who retired on May 2 as operating head of the company. **Mr. Wood** joined Girdler in 1929, became manager of the gas processes division in 1939; was elected vice president in 1941 and executive vice president in 1948; and became a vice president and director of the parent firm, National Cylinder Gas Co.

Dr. Alan A. Weinberg and **Bruce N. Wilson,** research chemists, have joined the staff of the plastics laboratory, research and development department, Hooker Electro-Chemical Co., Niagara Falls, N. Y. Dr. **Weinberg** has been assigned to polyester plastics research, while **Mr. Wilson** will work in the plastics research application group.

R. F. Uber, former Philgas sales engineer, has been promoted to manager of the newly-established district sales office in Bartlesville, Okla., of Phillips Chemical Co. The new office is the sixth to be established by the firm in preparing to meet the industrial demand indicated for the company's Marlex olefin polymers.

George H. Argue has been appointed director of research and development for the plastic impregnating division, Fabricon Products Div., Eagle-Pitcher Co., River Rouge, Mich. **Dr. Argue** has long been associated with Fabricon in the capacity of research chemist and, prior to his recent appointment, was engaged in various product development projects for the firm.

F. A. Gilbert

Frederick A. Gilbert has been elected president of Becco Chemical Division, Food Machinery & Chemical Corp., Buffalo, N. Y., succeeding **Max E. Bretschger** who retired on May 1st. Mr. Gilbert has been with Becco for 21 years in various production and research positions, serving as an administrative officer for the past several years.

George W. Martin has resumed the position of general manager, plastics division, Noma Lites, Inc., St. Joseph, Mo. **Edward F. Duda,** who had been acting as interim manager, becomes plant manager of that division.

Lawrence P. Thies has been named special representative of Goodyear Tire & Rubber Co.'s chemical division in the Cleveland district. He will be concerned primarily with the sales of Pliovic and Plio-Tuf resins.

James W. Kearns, Jr., has been appointed sales manager for Bigelow-Sanford Carpet Co.'s fiber glass products division, New York, N. Y. He joined the firm in 1953 as sales engineer, after prior service as the Eastern sales manager of Continental Can Co.'s plastics division.

Bernard W. Lueck has been named general sales manager of the reinforced plastics division, Minnesota Mining & Mfg. Co., St. Paul, Minn. He has over 20 years experience with the company in a number of sales and merchandising capacities.

Richard J. Bellet has joined the resins and plastics group of Hooker Electrochemical Co.'s research & development department, Niagara Falls, N. Y. **Dr. Bellet** is a recent graduate of Columbia University.

Donald A. Regnier and **Errol M. Thompson** have joined the technical staff, Resinous-Reslac Department of Borden Co.'s chemical division. Formerly with Plymouth Rubber Co., **Mr. Regnier** will serve industrial customers in Ohio. **Mr. Thompson** will service the New England area from the Peabody, Mass., plant.

Allen E. Terman has been appointed technical sales representative in the Chicago area for Durable Formed Products, Inc., New York, N. Y. He will service both industrial plastics and lighting division accounts.

T. T. Lewandowski has been named assistant sales manager of the plastics division, O'Sullivan Rubber Corp., Winchester, Va. His responsibilities will include handling sales of Sullvyne-Clad metal laminates and Sullvac thermoplastic sheeting.

Howell D. Chickering has been appointed Eastern district sales manager, film department, E. I. du Pont de Nemours & Co., Inc. He succeeds **Veasey C. Clark,** who retires after 43 years of service. **Mr. Clark,** who had been serving as assistant New York district manager, will maintain offices in Philadelphia, Pa.

Howard Jerome has been named Midwest technical sales representative, PVA emulsions, for Celanese Corp. of America. Formerly associated with E. F. King Co., and Moderne Paint Co., he will work out of the Chicago office.

Ralph L. Poskitt has been appointed research & development manager for Minnesota Mining & Mfg. Co.'s adhesives and coatings division, Detroit, Mich. He has been in charge of technical planning within that division for the past year.

Ross H. Dean has been named sales manager for Sterling, Inc., Milwaukee, Wisc., manufacturers of temperature control equipment. A graduate mechanical engineer from Purdue University, **Mr. Dean** was the former sales manager of the special products division of Pressed Steel Tank Co.

N. C. Robertson

Robert U. Haslanger and **N. C. Robertson** have been appointed president and vice president, respectively, for Escambia Bay Chemical Corp., New York, N. Y. Mr. Haslanger succeeds **Kenneth G. Donald,** who resigned to devote full time to his duties as vice president and treasurer of National Research Corp. Mr. Haslanger joined Escambia Bay earlier this year as vice president and general manager. Dr. Robertson formerly served as director of research for the firm.

H. D. McLeese

H. D. McLeese has been elected a vice-president of Metal & Thermit Corp., New York, N. Y. Named general sales manager of that firm in 1955, he will continue as the company's chief sales executive in addition to his new duties. His past experience includes positions with Bell Laboratories, Dow Chemical Co., Chemical Treatment Co., Chromium Corp. of America, and United Chromium, Inc., the latter two being affiliates of Metal & Thermit.

Richard K. Shelby has been named assistant to the executive vice president of Continental Can Co.'s non-metal divisions, New York, N. Y. He will be concerned with the coordination of plastics development projects.

J. S. Bruskin

J. S. Bruskin has been named general manager of the films & flooring division, Goodyear Tire & Rubber Co., Akron, O. With the firm since 1949, when he joined Goodyear as manager of the Vinylfilm department, **Mr. Bruskin** served as sales manager of the films & flooring division since 1955. In his new position, he will be assisted by and work in coordination with **J. E. Mayl,** subsidiary vice president in charge of films, foam, and flooring.

Dewey H. Nelson has been appointed assistant sales manager of Food Machinery & Chemical Corp.'s Becco Chemical division, Buffalo, N. Y. **James F. Whalen, Jr.,** Southeastern district salesman, succeeds **Mr. Nelson** as Midwest district sales manager, **Edward A. Dalmas** has joined the Southeastern sales staff.

Charles J. Williams and **Russell S. Davis, Jr.,** have been appointed managers of the Rochester, N. Y., and Newark, N. J., districts, respectively, for National Vulcanized Fibre Co., Wilmington, Del. Mr. Williams joined the firm in 1936, and has served in various positions in the promotion, customer service, and sales departments. Mr. Davis has more than eight years of experience with the company, and was formerly associated with the New York sales office.

F. Albert Smiles, former director of technical service for Reichhold Chemicals, Inc., White Plains, N. Y., has been named general manager of the firm's Elizabeth, N. J., plant, replacing **S. H. Baum** who was recently elected executive vice president of the company. In addition to being the operating head of the plant, **Mr. Smiles** will be in charge of technical service for RCI's customers in the metropolitan New York area, upper New York State, New England, Pittsburgh, Baltimore, Washington, D. C., and Virginia. **Dr. C. A. Knauss,** former vice president in charge of Eastern sales service, has been appointed vice president in charge of coating resins.

L. Robert Clinton has been promoted from assistant to purchasing agent for National Vulcanized Fibre Co., Wilmington, Del. Prior to joining National in 1952, he was associated with the Lestershire Spool & Bobbin Co.

C. W. Kleiderer

Charles W. Kleiderer has been appointed vice president for sales and a director of Penn-Plastics Corp., Glenside, Pa. **Mr. Kleiderer** has 19 years of service in the plastics industry as a research chemist, salesman, sales manager, and executive. During World War II, he served with the OSRD as production and development engineer in charge of various plastics applications.

C. H. Litz has been made assistant sales director of the sheet and molding materials department, plastics division, Celanese Corp. of America, New York, N. Y. With the firm for 15 years, **Mr. Litz** will be responsible for sales of extruded cellulose acetate sheet in the optical frames, vacuum forming, lampshades, guide cards, and graphic arts markets.

Plax Corp., Hartford, Conn., has announced the following promotions in its research, development, and engineering department: **Grant S. Brown,** to manager of research; **Robert G. Strauss,** to assistant research manager responsible for blownware engineering; **Richard J. Morcom,** to assistant research manager in charge of extrusion engineering; and **Robert L. Doughty,** to design engineer. **Edwin L. Fuerst** has joined the company as special assistant to the vice president in charge of sales, after a long career as design and packaging specialist.

W. Mayo Smith

Horace W. Boynton

Horace W. Boynton and **W. Mayo Smith** have been named assistant directors of research for Escambia Bay Chemical Corp., Cambridge, Mass. Formerly associated with North American Cyanamid, Ltd., **Mr. Boynton** will direct engineering and fertilizer research. **Dr. Smith,** formerly of Firestone Tire & Rubber Co., will be in charge of polymerization and plastics research and development.

Carbide & Carbon Chemicals Co., New York, N. Y., has appointed the following district managers and assistant district managers:

R. A. Corio as manager, Newark district.

M. R. Kleeman, Newark assistant manager.

B. A. Gustin as manager, Boston district.

R. J. Hughes as Philadelphia district manager.

J. F. Luther as manager, Charlotte, N. C., district.

J. R. Retter as district manager, Albany, N. Y.

William Samson as assistant district manager in Detroit.

D. E. Murphy has been appointed a technical sales representative for Nopco Chemical Co., Harrison, N. J. Associated with the chemical industry for many years, **Mr. Murphy** has been assigned to Nopco's Southern California sales district, with headquarters in Los Angeles.

C. W. Foster, formerly sales manager for Bryant Electric Co.'s plastics activities department, is now serving as sales manager for the firm's wiring device division. **Ronald W. Essig** has taken over **Mr. Foster's** previous duties in Bridgeport, Conn.

Arthur S. Weygandt has been appointed manager of the central development department of Food Machinery & Chemical Corp., with headquarters in New York, and **William D. Morrison** has been appointed to the new post of manager of foreign chemical development. A chemical engineering graduate of Case Institute of Technology, **Mr. Weygandt** has had long service with du Pont, Continental Research Corp., and Rockland Corp. **Mr. Morrison** has held various development posts at Celanese Corp. of America and, in his new position with FMC, will be responsible for new commercial opportunities abroad.

M. J. Skeeters and **Alex Hlynsky** have been named manager of research and group leader for research, respectively, for the chlorinated products division, Diamond Alkali Co., Cleveland, O. Formerly the acting manager of research, **Dr. Skeeters** joined the firm in 1942 after having been with National Aniline Division of Allied Chemical & Dye Corp. **Mr. Hlynsky** came to Diamond in 1950 after receiving an M.S. in chemistry from Cornell University. Both men will continue to be located at the firm's Painesville, O., works.

Thomas C. Ackerly has been named sales manager of Brilhart Plastics Corp., Mineola, N. Y. He has been with the firm for five years, serving as assistant sales manager for the past two years.

Edward A. O'Neal, Jr., has been elected president of Chemstrand Corp., Decatur, Ala., to fill the vacancy created by the resignation of **Henry H. Bitler** who is returning to American Viscose Corp. **Mr. O'Neal** has resigned as vice president and director of Monsanto Chemical Co. to take over his new duties with Chemstrand. He was with Monsanto since 1935, serving as research chemist, assistant supervisor, supervisor, plant manager, production manager, and executive.

George H. Martin

George H. Martin has been appointed Canadian sales manager for Plaskon plastics (urea, melamine, alkyd, and nylon molding compounds) by The Barrett Co., Ltd., Montreal, P. Q. He will be headquartered in Toronto, and will manage the Montreal and Toronto sales districts. Mr. Martin was a sales engineer for Canadian Industries, Ltd., while that firm was Canadian representative for Plaskon plastics.

OBITUARY

Edwin P. Nicholson

Edwin P. Nicholson, sales representative of Givaudan-Delawanna, Inc., Givaudan Flavors, Inc., and Sindar Corp., died May 24 after a five-month illness. He was 57 years old.

Mr. Nicholson had served the aromatic chemical and related industries for 36 years, the last 25 of which were spent with Givaudan. He is survived by his wife and three daughters.

New Materials

Write item numbers on Readers' Service Card to obtain more information.

Elastomeric Label Adhesive

An elastomeric, aqueous-base adhesive for attaching paper labels to such plastic surfaces as acetate, styrene, butyrate, vinyl, and both treated and untreated polyethylene, has been developed by Adhesive Products Corp. Called Labelgrip, the material is used with normal labeling equipment.

Tests show that a Labelgrip bond will endure after submersion in water for several days. The same situation held true for gasoline and oil solutions. Another feature claimed for the adhesive is high initial tack, which prevents the label from slipping while being set.

Readers' Service Item M-1

Low-Tack Vinyl Plasticizer

A primary plasticizer for PVC which reduces tack by more than 70% has been introduced by Monsanto Chemical Co.'s organic chemicals division. Designated Santicizer 213, the material largely eliminates the undesirable gripping quality encountered in vinyl-coated fabrics and films.

Santicizer 213 performs best in combination with other primary plasticizers. A minimum concentration of 25% is required to obtain a relatively tack-free surface, and the other plasticizer can be chosen for heat and light stability properties. The material also produces plastisols with low initial viscosities; enhances fusion characteristics; and improves the gloss of molded, calendered, and extruded items.

The new plasticizer is expected to cut down soiling in floor tile, and act as a release agent in slush molding. Property data are listed as follows:

Color	Water-white
Odor	Very slight
Specific gravity	1.0042
Viscosity, cks., at 100°F.	13.22
At 210°F.	2.73
Fire point, °F	330
Flash point, °F.	305
Acid value, meq./100 gms	0.33
Fusion point, °C.	105
Coefficient of friction in films, 87 phr	0.5
Low-Temperature flex, Clash & Berg, °C.	—21
Hardness, Shore A, before volatility	82
After volatility	85
Kerosene extraction, 24 hrs. at room temp., % lost	5.2
Volatility, activated carbon, 24 hrs. at 87° C., % lost	18.1
Water sensitivity, 24 hrs at 50°C., % absorbed	1.23
Solubles leached, %	0.54

Readers' Service Item M-2

Organic Color Pigment

An organic color pigment featuring such qualities as brilliant shade, excellent permanence, high heat resistance, and ease of dispersion, has been developed specifically for the plastics industry by Sherwin-Williams Co. Designated Pyrolux Maroon D-3148, the material is reported to be especially effective with PVC, vinyl copolymers, polystyrene, and polyethylene.

D-3148 is in the same shade range as the company's Plasticone Maroon 10458 and Permachrom Maroon CP 429, but is said to be considerably brighter. Other properties reported for the material are good to excellent light resistance; ease of grinding; resistance to water, acids and alkalies; and no-bleed in plasticizers, synthetics, lacquer, and mineral spirits. Specific gravity is 1.84, and oil absorption is 53%.

Readers' Service Item M-3

Rigid PVC Extrusion Compound

A rigid vinyl extrusion compound which employs no rubber modifiers or plasticizers has been introduced by General Tire & Rubber Co.'s chemical division, Designated Vygen 1101 the material is a type I compound which reportedly features optimum chemical resistance and good heat stability during processing.

The most favorable conditions, as compiled from a normal run of two-inch, schedule 80 ips. pipe on a twin-screw machine with breaker plate and one 20-mesh screen, are reported as follows:

Barrel temperature, °F	355
Die adaptor temperature, °F	355
Die temperature, °F	360
Temperature of stock from die, °F	360
Power, amps	14
Feed rate	8
Screw speed, rpm	15

Mechanical, thermal, and miscellaneous properties for Vygen 1101 are quoted in the following tabulation:

Specific gravity	1.42
Hardness, Shore D	82
Tensile strength @ 77°F., psi	7,000
At 150°F., psi	4,000
Elongation at yield point, %	5
Flexural strength, psi	12,000
Flexural modulus, psi	400,000
Impact strength, Izod, ft.lbs./in. notch	0.8-1.1
Thermal conductivity, cal./sec./sq. cm./°C./cm.	3.3×10^{-4}
Heat capacity, cal./gm./°C.	0.25
Coefficient of linear thermal expansion, in./in./°C.	5×10^{-5}
Heat distortion point at 264 psi., °F	170
At 66 psi. °F	178
Flammability	Self-extinguishing
Water absorption, % wt. increase after 30 days @ 77°F	0.055
After 1 year	0.114

Readers' Service Item M-4

Four Styrene Formulations

Four new styrene formulations have been introduced by Dow Chemical Co., bringing the total to 11 different types of Styron polystyrenes produced by that firm. Designated Styrons 429, 440, 665, and 689, the materials reportedly possess the following specifications:

Styron 440 combines high impact strength and heat resistance with the inherent properties of general-purpose styrene. Applications suggested for the material include radio cabinets, vacuum cleaner housings and parts, housewares, photocopying machine and camera parts. Property data obtained on injection molded specimens are reported as follows:

Tensile strength, psi.	5,000-6,200
Elongation, %	7.5-12
Modulus in tension, psi.	4×10^5
Impact strength, ft.lbs./in. of notch	2.4-3.4
Heat distortion, annealed, °F.	203-205
Flammability, ⅛-in. bar, in./min.	1.1-1.3
Rockwell "M" hardness	51
Specific gravity	1.04
Dielectric constant, 10^6 cycles	2.5
Dissipation factor, 10^6 cycles	0.001-0.0015
Thermal coefficient of expansion, in./in./°C	$8\text{-}10 \times 10^{-5}$

Styron 429 is a rubber-styrene blend developed primarily for extrusion purposes. Main attributes are toughness and

gloss, and sheets can be vacuum formed with good retention of surface qualities. Data obtained on specimens cut from 0.80-inch extruded sheet are reported as follows:

Tensile strength, psi	3,000-3,800
Elongation, %	1.5-3
Modulus intension, psi.	$4x10^5$
Impact strength, Izod, ft./lbs./in. of notch:	
At 73°F	0.7-1
At 10°F	0.4-0.8
At —20°F	0.3-0.4
Rockwell "M" hardness	10-20
Heat distortion at 264 psi., °F	170-180
Flammability, in./min.	0.9-1.5
Specific gravity	1.04
Water absorption, 24 hrs., %	0.16
Dielectric constant, 60 cycles	2.72-2.75
At 10^6 cycles	2.65-2.69
Dissipation factor, 60 cycles	0.0004-0.0008
At 16^6 cycles	0.0015-0.0017

Styron 689 was developed to satisfy the demands of faster injection molding. It is said to feature easier flow and faster set-up time than other presently-available materials. Specific applications include packaging and thin-walled containers. Properties are as follows:

Tensile strength, psi.	4,500-5,5
Elongation, %	1.2-1
Modulus in tension, psi.	4.4-4.8 x 1
Impact strength, ⅛-in. bar, notch, ft.lbs./in.	0.3-0
Flexural strength, psi.	12,000-15,0
Heat distortion temperature, annealed, °F	173-1
Flammability, in./min.	0.7-0
Rockwell "M" harness	
Specific gravity	1.0
Dielectric constant, 10^6 cycles	2
Dissipation factor, 10^6 cycles	0.00
Refractive index	1.5
Transmission, total luminous, %	88-9
Thermal coefficient of expansion, in./in./°C	8-10 x 10-

Styron 665 is a general-purpose formulation, especially tailored for extrusion. Suggested applications include bristles, rods, and tubes. Properties are reported as follows:

Tensile strength, psi.	6,80
Elongation, %	1
Modulus in tension, psi.	4.7 x 10
Impact strength, ft.lbs./in. notch	0.
Heat distortion, annealed, °F	19
Specific gravity	1.0
Dielectric constant, 10^6 cycles	2
Dissipation factor, 10^6 cycles	0.0002-0.000

Readers' Service Item M-5

VANSTAY Z

zinc bearing chelator for PVC resins imparts outstanding clarity, stability and resistance to sulfur staining when used as recommended with other VANSTAYS in many vinyl products.

Plastisols, Organosols, Extruded Goods

Use 1.5 VANSTAY R with .5 VANSTAY Z for maximum resistance to process heat and good service life.

Film, Sheeting, Molded Products

Use 1—1.5 VANSTAY HT with .5—1.5 VANSTAY Z to obtain the required protection.

When Roll plating is a problem:

Use 1.5 VANSTAY N with 1.5 VANSTAY Z as the stabilizing system.

Our Technical Service Representatives will gladly demonstrate the merits of our materials in your plant and assist in solving production problems.

Oliver

R. T. Vanderbilt Co., INC.

230 PARK AVENUE, NEW YORK 17, N. Y.

Phthalocyanine Green Toner

The pigments division of American Cyanamid Co. has announced the addition of a phthalocyanine green toner to its expanding line of pigments for the plastics industry. Designated Cyan Green Toner 15-3100, the material is said to possess high strength and excellent stability to light in exterior finishes.

Chemically, the material is a chlorinated copper phthalocyanine. Working properties are reportedly good, particularly with respect to dispersion and freedom from bodying. Applications range from paints to plastics and floor coverings. It is not affected by peroxides which are used in the curing of polyesters and is sufficiently stable to withstand extended curing cycles.

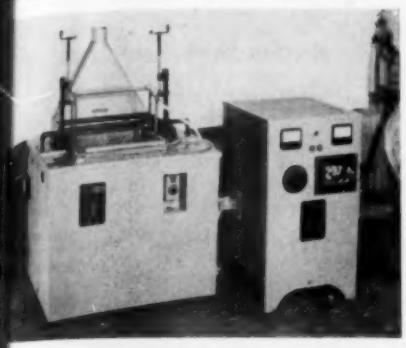
Following are property data reported for the material:

Specific gravity	2.24
Weight, lbs./cu. ft.	139.1
Light stability after 300 hrs. in tint	Excellent
Heat stability, styrene molding, 550°F., min.	30
Bleed	None
Exudation in vinyl sheeting	None
Crocking	None

Readers' Service Item M-6

New Equipment

Write item numbers on Readers' Service Card to obtain more information.



Dawson's chrome plating tank (left) and rectifier unit (right).

Chrome Plating Unit

A chrome plating unit, designed to accommodate large size metal-forming and plastic-molding dies, engraving plates, shafts, and other heavy equipment, has been introduced by Dawson Corp., Known as the Model 300 Chromplater, the unit has a plating tank measuring 15 by 20 by 30 inches deep.

Two 3,000-watt electric immersion heaters and a heavy-gage steel waterjacket provide accurate control of the plating bath through an adjustable thermostat. The work platform is plastisol-coated steel, with bus bar supports and Acme thread height adjustment for maximum plating efficiency.

A separate rectifier unit, which provides a 300-ampere, D.C. output to the plating bath, operates on a standard 200-volt, three-phase, 60-cycle connection. Both units are of angle iron frame construction, with blue hammertone-baked enamel finish. Tank unit dimensions are 38 by 28 by 33 inches high; the rectifier is 22 by 22 by 40 inches high.

Readers' Service Item E-1

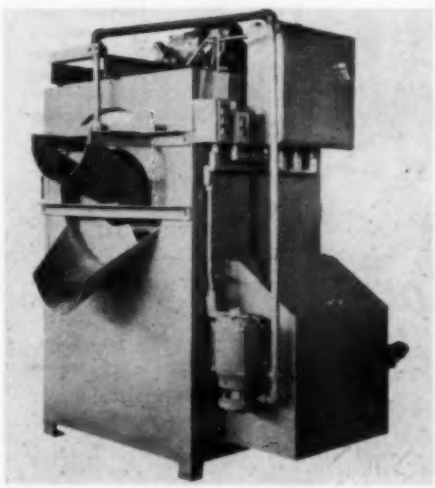
Batch Rotary-Drum Machine

A new machine for high pressure-spray washing of small plastic parts has been introduced by Alvey-Ferguson Co., Batches of parts are introduced into the machine through the upper chute, where they are tumbled gently in a helically-spiraled drum. This exposes all part surfaces to the high-pressure, fan-spray nozzles.

The drum is perforated to permit draining of the cleaning solution and impurities. Upon completion of the cleaning cycle, the drum counter-revolves, automatically discharging the clean parts through the lower chute. Cycles can be either manual or automatic, and an adjustable timer is provided for the latter. Drums are available for any given drum capacity. Steam, gas, or electricity may be used to heat the cleaning solution.

The machine measures three by 4½ feet, and stands six feet in height. Plate housing is 3/16 inches thick, and 12-gallon drums are standard. Other specifications are reported as follows:

Drum load caapcity, cu.ft./batch (std.)	1.25
Motor, hp.	1/3
Tank capacity, gal.	150
Pump capacity, gal./min.	30



Alvey-Ferguson small parts batch washer.

Readers' Service Item E-2

Plastisol Coating Unit

A laboratory-type unit for coating small parts and assemblies with PVC plastisols has been placed on the market by Quelcor, Inc. Referred to as the Do-It-Yourself coating unit, it consists of a special cabinet designed to accommodate dip materials, curing device, welding unit, and test equipment.

The plastisol container is stored on an adjustable bracket on the door, and is immediately in operating position when the door is opened. The curing device consists of three infra-red strip heaters controlled by a common power in-put regulator, and each with its individual switch. Parts can be preheated either by placing them over the base heater or by rotation on the spindle. Rotation is used for cure.

Quelcor's self-contained plastisol coating unit.

The unit is furnished with three grades of Quelcor plastisols and a primer. Other standard equipment items include a 42-volt Schrupp welding gun with powerstat for repairing plastisol coatings and rigid PVC weldings; a portable compressor with hose for air supply to the welding gun; a sparktester; and tools. The unit measures 36 inches wide, 24 inches deep, and 33 inches in height.

Readers' Service Item E-3

TESTED IS TRUSTED

What's YOUR plastics testing problem?

Can it be related to . . .

TENSION COMPRESSION FATIGUE

We are glad to put at your disposal over 50 years experience in building test equipment to evaluate these factors.

MAY WE HELP?

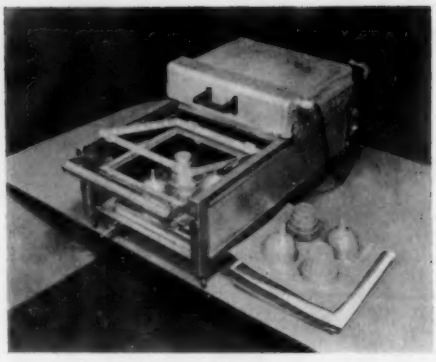
SCOTT TESTERS, INC.

149 Blackstone St., Providence, R. I.

Small Vacuum Forming Machine

A small testing machine for making sample formed parts and market-testing of Skin-Pak packages has been introduced by Auto-Vac Co. Designated Lab-Vac, the unit can be used for both drape and straight vacuum forming of sheets measuring up to 16 by 16 inches.

Construction is of welded steel with aluminum castings. Toggle switches are provided for heater and vacuum pump. Draping action and heater movement are manually controlled; however, a heat-cycle timer is available as optional equipment.



Lab-Vac vacuum forming machine.

The clamping frame is adjustable for sheet thicknesses from 3-180 mils.

The heater is an infra-red rod type, and operates to 1,200° F. Fully insulated, the machine has a uniform heat-output. Other specifications are listed as follows:

Stroke, in.	7
Table space required, in.	24 x 9
Weight, lbs.	150
Platen size, in.	18 x 1
Heater capacity, kw.	3.5
Vacuum pump, cu. ft./min.	2.2
Surge tank capacity, gal.	7

Readers' Service Item E-4

"Colloid Corner" by COLUMBIAN

For Plastic Flooring... Colors that stand up!

Plastic flooring takes hard wear and harsh cleaning... but MAPICO Synthetic Iron Oxide pigments never fade

Great chemical stability . . . extreme light-fastness . . . a wide range of beautiful reds, browns, tans, yellows and black... MAPICO® offers plastics *beauty that can take a beating!* In vinyls and polyester resins, in floorings, sheetings, coated textiles, luggage stocks, dolls and many other things, MAPICO does an excellent job. Choose to suit your need from among the many varieties of MAPICO. All are uniformly synthesized in modern factories. A nationwide network of well-stocked warehouses will supply you promptly. For a reliable source of Synthetic Iron Oxides, turn to MAPICO. Or, for technical assistance on proposed applications, write today. There is no obligation.

For Progress in Colloids

COLUMBIAN CARBON COMPANY
380 Madison Avenue, New York 17, N. Y.
CARBON BLACKS · SYNTHETIC IRON OXIDES · DISPERSIONS

Air-Activated Heat Sealer

A compressed air-activated heat sealing machine, called the Proxsealer, has been introduced by Pyroxylin Products, Inc. Designed for continuous, small-scale operations, the unit seals preformed plastic blisters to the desired base in about six seconds.

Temperature required for the operation is 350° F., and the user supplies his own template of either plywood or metal. The Proxsealer is provided with a long base for bench or table mounting. Optimum level is approximately 39 inches above the floor. Fixed or flexible connections to a compressed air supply, or an air compressor can be used.

Proxsealer automatic heat sealer.

Pressure for sealing is provided by an air-operated cylinder fitted with an electrically-operated valve. The air regulating unit consists of a water trap, a pressure regulator, gage, and air cylinder lubricator. Operating pressure is 80 pounds.

The 500-watt, 110 volt heating unit is especially designed in cast aluminum to accommodate heavy-rod heating elements, and is thermostatically controlled. Preformed films are placed on the template and filled. The machine arm swings out to allow the operator to work at a safe distance from the sealing iron.

Readers' Service Item E-5

New Products

Write item numbers on Readers' Service Card to obtain more information.

Cellulose Acetate Lacquer

A synthetic, quick-drying lacquer, specially formulated for coating and decorating cellulose acetate, has been introduced by Schwartz Chemical Co., Inc. Named Rez-n-Lac A, the lacquer is reported to contain a chemical which alters the polarity of acetate so that complete and permanent adhesion results without further treatment.

The base resin has been approved for use in food packaging, therefore it may be safely used on children's toys and other objects which come into contact with the body. Drying time has been adjusted to five minutes for a medium coating; however, this time may be shortened by the use of a mist spray, a drying tunnel, or a belt moving under a series of infra-red lamps. The use of retarders permits a more-leisurely brush operation.

Only Rez-n-Lac A thinner should be used, since commercial thinners containing large amounts of xylol, toluol, or mineral spirits will cause precipitation. Since the material contains no nitrocellulose, it should not be mixed with nitrocellulose lacquers. All standard colors are available, either opaque or transparent.

Readers' Service Item P-1

Vinyl Plastisol Fishing Lures

Brilliantly colored fishing lures, simulating a wide variety of insects, can be made by the fisherman at home with a new open-molding process kit developed by Clinton Sales, Inc. This Make-Ur-Bait kit consists of an aluminum mold with three different cavities, a steel pin, and a vinyl plastisol in four different colors.

Open-molding of lures with vinyl plastisols.

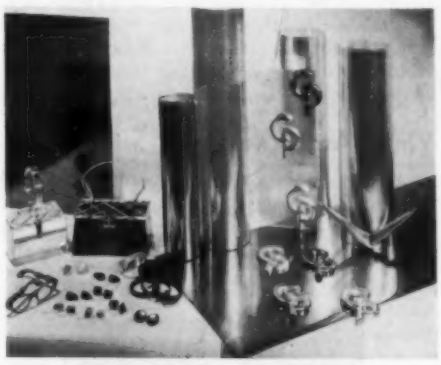
The liquid plastisol is dropped into the mold cavity by means of the steel pin, using the sharp end to draw the material into the antennas, feelers, or legs. Curing time is 1-3 minutes, and can be accomplished through the use of an electric hot plate, stove, flat iron, or toaster.

Twelve different molds are currently available, ranging from items as small as an ant on up to a frog. The plastisol compound is supplied by Kee-Bair Products, Inc., Cleveland, O., using B. F. Goodrich Chemical Co.'s Geon vinyl resin 121.

Readers' Service Item P-2

Pearlescent Acrylic Sheet

Cast acrylic sheet with natural mother-of-pearl uniformly diffused throughout is now manufactured by Cadillac Plastic & Chemical Co. Reportedly of exceptionally high luster and color penetration, the sheet is available in more than 20 jewelled and metallic colors, and in thicknesses from 80-250 mils. Sheet sizes range from 12 by 48 inches up to 36 by 48 inches.



Items fabricated from Cadillac's pearlescent sheet and tube.

The pearlescent sheet line supplements Cadillac's cast pearl acrylic rods and tubes. Applications are expected in costume jewelry, decorative buttons and handles, automotive and refrigerator nameplates, spectacle frames, housewares, handbags, and novelties.

Readers' Service Item P-3

Lumelite all-Polyethylene dropper.

Polyethylene Medicine Dropper

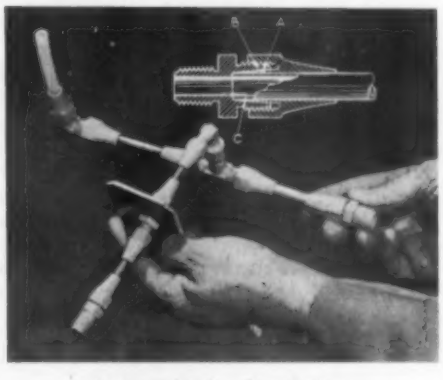
An all-polyethylene medicine dropper, which controls the size of droplets with scientific precision, has been introduced by Lumelite Corp. Based on a Bakelite formulation, the new dropper-bottle closure permits critical drugs to be administered accurately, and without danger of contamination or breakage.

Instead of the usual squeeze bulb, the polyethylene diaphragm responds to easy finger-pressure to release uniform droplets at the rate of 30 per cubic centimeter. To form a primary seal that screws firmly on the bottle, other parts of the dropper assembly are molded of Bakelite polyethylene except for the band at the top of the cap. Polyethylene remains flexible at refrigeration temperatures, an important factor in the storage of many medicines.

Readers' Service Item P-4

Nylon Tube Fittings

A simplified line of tube fittings which incorporate the compression section as an



Jaco molded nylon fittings.

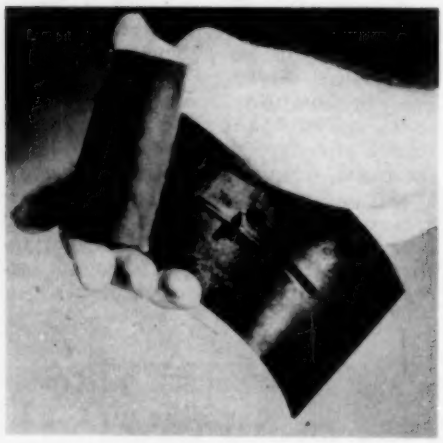
integral part of the nut is available through Jaco Mfg. Co. Molded from DuPont's Zytel nylon resin, the two-part fittings require no flaring of the tube, and can be re-used. Further simplicity is achieved since every joint is a union.

Jaco fittings have been submitted to standard vibration tests, and have gone to well over 22 million cycles without fracture. Burst strength is reported to be well in excess of requirements. Since nylon is a non-conductor, the danger of electrolytic corrosion at joints is eliminated. The fittings are available for tubing with outside diameters ranging from ¼- to ½-inch.

Readers' Service Item P-5

Molded Polyethylene Wrappers

Molded polyethylene joint wrappings around field tile are proving more effective in keeping soil and stones from sewage disposal systems than the conventional tar-paper wrappings previously used, according to recent reports from the field. Molded from Bakelite material by Mayfair Plastics, the items are known as Boco tile clips, and are available through Boco Industries, Inc.



Boco polyethylene joint clip for field tile.

Field tiles are sections of clay drainpipe used to carry away excess ground water from insufficiently drained areas, or disperse liquid waste from private sewage disposal systems. Individual tiles are spaced ⅜-inch apart to allow for expansion, and the new clips provide this through lugs molded on the inside.

The clips are 2½ inches wide, and are long enough to cover the top and sides of the tiles. The tile bottom remains open for sewage dispersal and collection. A fin molded into the top serves as a handle for snapping the tile clip in place, and as a guide for proper alignment. The clips were designed for four-inch tile, but are said to work equally well on either three- or five-inch tile.

Readers' Service Item P-6

Bilnor's vinyl-lined swimming pool.

Vinyl Swimming Pool Liner

An above-ground, circular swimming pool, which is 25 feet in diameter and holds about 12,000 gallons of water, has been introduced by Bilnor Corp. Salient features of the Happy Harbor pools are the liner of Bakelite's Krene vinyl film, and the 42-inch sidewalls supported by a sturdy, plastic-coated wire fence.

The heavy-gage pool liner withstands the great weight of the water without tearing, and can be folded repeatedly without cracking or peeling. The pool is assembled by rolling out the wire fence to form a complete circle, and fitting the liner inside it. The liner is then filled by hose or other means. An inflatable vinyl bumper around the top of the sidewall protects swimmers on entering and leaving the pool. Smaller models 8½, 12, 16, and 20 feet in diameter are also available.

Readers' Service Item P-7

Vinyl Anti-Radiation Suit

An anti-radiation suit for laboratory and industrial workers who deal with dangerous gases and radioactive particles has been developed by Snyder Mfg Co., using Goodyear Tire & Rubber Co.'s Vitalon vi sheeting. Tough and pliable, the garme has been accepted by the Atomic Ener Commission, and is highly resistant ripping and puncture.

Despite its bulky appearance, the suit exceptionally light-weight and permits fre dom of movement. An air-conditioning sy tem attached to a compressed air outl assures worker comfort. The suit is zippe and inflated to the desired pressure, which point air is circulated to the fac shoulders, and legs.

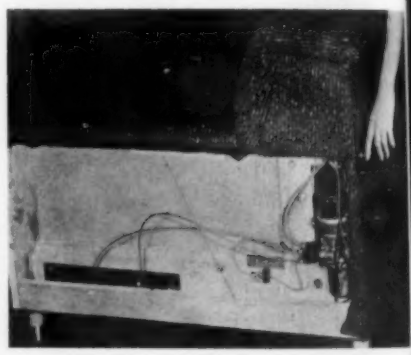
Fog-free, unhampered vision in all direc tions is offered by the panoramic face piece. Most important, however, the su affords a high degree of protection fro radioactive contamination, corrosive liq uids, fumes, dust, and bacteria.

Snyder's Vitalon anti-radiation suit.

Readers' Service Item P-8

Flexible Nylon Conveyor Tubing

Specially-processed, flexible nylon tubing has been introduced by Polymer Corp. of Pennsylvania, under the trademark Nylaflow. The tubing is available as Type T with a burst pressure of 1,000 psi., and as Type H with a 2,500-psi. burst pressure. Both are marketed with outside diameters ranging from ⅛-⅜ inch and in lengths of 100-500 feet.



Nylon hydraulic lines operate push-button mechanism for convertible sofa.

Engineered for hydraulic, air, vacuum, fuel, and oil lines, Nylaflow has a bonelike structure which affords good impact resistance. Other features include high resistance to flex and vibrational fatigue, abrasion and corrosion resistance, and ease of installation. In addition, the tubing has half the weight of aluminum, and ⅓ that of copper.

Teamed with a miniature pump, Nylaflow made practical the radically-new Hydramatic convertible sofa. Capable of withstanding pressures up to 2,500 psi., the tubing furnishes the hydraulic lines for the motor, which opens and closes King Koil's push-button sofa bed.

Readers' Service Item P-9

New Literature

Write item numbers on Readers' Service card to obtain more information.

"Picture a New HPM on Your Plastics Production Line." Injection Bulletin No. 601. Hydraulic Press Mfg. Co. 12 pages. This bulletin illustrates and lists specifications for the entire line of injection molding machines produced by the firm. Product photos are included.

Readers' Service Item L-1

"Spotlight on Permanence in Plasticizers." EM-928. Emery Industries, Inc. 8 pages. The firm's Plastolein 9720 fluid plasticizer is described in this circular. Graphs depicting volatility, mineral oil extraction, gasoline extraction, and heat stability are included.

Readers' Service Item L-2

"Gross Heat Transfer Insert." F. R. Gross Co. 4 pages. This bulletin describes an insert for calender and laminator rolls which cools them by directing water flow against the inner sides of the roll. It consists essentially of flexible rubber ribs vulcanized to a metal drum, and affixed to the outer shell by bolts with O-ring gaskets.

Readers' Service Item L-3

"1956 Reference Guide to Dow Corning Silicone Products." Dow Corning Corp. 12 pages. This new edition describes and illustrates 150 of the silicone products in common usage. Products are indexed by physical form (fluids, compounds, greases, resins, and rubbers); cross-indexing is according to application.

Readers' Service Item L-4

"Ucon Fluids and Lubricants." Form 6500D. Carbide & Carbon Chemicals Co. 52 pages. Properties, characteristics, and applications for these polyalkyleneglycol derivatives are covered in this booklet. They are supplied in both water-soluble and water-insoluble forms either with or without additives. Special features claimed for the compounds include high viscosity indexes, low pour points, and excellent lubricity.

Readers' Service Item L-5

"Merix Anti-Static." Bulletin No. 3. Merix Chemical Co. 4 pages. Uses for the firm's two static removers, #79 and #79-OL, are described in this catalog. Price data are included.

Readers' Service Item L-6

"Urethan Resilient Foams Made from Polyesters." HR-10. E. I. du Pont de Nemours & Co., Inc. 14 pages. Diisocyanates are reacted with a polyester resin and water to form resilient foams. Physical properties of the foams are given, and comparisons between these foams and those of rubber are depicted in a series of charts. Among the latter are compression set, tear strength, elongation, and solvent resistance.

Readers' Service Item L-7

"Chemistry of Organic Isocyanates." HR-2. E. I. du Pont de Nemours & Co., Inc. 38 pages. Methods of making isocyanates and their various reactions are described in detail. Numerous tables and structural formulas are included. Of particular interest to the polymer chemist are the reactions of the polyisocyanates to form high-molecular weight materials.

Readers' Service Item L-8

"Premix Molding." American Cyanamid Co. 9 pages. This bulletin describes the general properties of Cyanamid's Laminac polyester resins, methods of compounding and molding, and gives specific formulations. A property table for glass-filled compounds is included.

Readers' Service Item L-9

"Imagineering for Profit." Bulletin C-6-226. Koppers Co., Inc. 12 pages. This booklet describes many end-use applications for Dylite expandable polystyrene, with particular reference to the do-it-yourself market.

Readers' Service Item L-10

"Marcolite Aluminum and Fiber Glass Panel Skylights." The Marco Co. 8 pages. This illustrated catalog lists specifications and size schedules for the firm's prefabricated and pre-assembled skylight units.

Readers' Service Item L-11

"Polyethylene." Volume IX, No. 1. Monsanto Chemical Co. 36 pages. The present and future of polyethylene is discussed in this illustrated booklet. Property data are given, along with a description of applications in film, injection molding, wire and cable coatings, pipe, and bottles.

Readers' Service Item L-12

"The Durez Guide to Resin-Coated Sand." Durez Plastics Division, Hooker Electrochemical Co. 16 pages. This guide outlines the methods by which sand can be coated with phenolic resins; liquid resin and powdered resin, high-boiling solvent plasticizer and powdered resin, hot sand and a Novolak resin, powdered resin and a solvent, and powdered resin and a mixture of solvent and water. Procedures are explained along with a tensile test for shell molds.

Readers' Service Item L-13

"Diamond in the Three-Dimensional View." Diamond Alkali Co. 24 pages. This performance report on the company consists of three talks by the president and two vice presidents before a group of security analysts and investment counselors.

Readers' Service Item L-14

"Alsynite, the Original Translucent Fiberglas Building Panel." Brochure RC 356. Alsynite Co. of America. 4 pages. This full-color brochure shows the full range of colors for the Riviera and Steplap lines, as well as their decorative applications.

Readers' Service Item L-15

"Decorative Overlay." SK-186. American Cyanamid Co. 4 pages. The use of decorative overlays in such molded melamine parts as dinnerware is covered, including molding techniques and variables.

Readers' Service Item L-16

"Melamine Molding Compounds." American Cyanamid Co. 70 pages. This handbook discusses general and specific properties of melamine molding compounds, their storage and handling, molding procedures and variables, part design, and applications. All of these compounds are now known as Cymel molding materials, though not so designated in this handbook.

Readers' Service Item L-17

"Uvinuls—Ultraviolet Light Absorbers." Antara Chemicals. 20 pages. Properties, absorption characteristics, stability, applications, and the place of Uvinuls in the spectrum are described in this booklet. Several charts and schematic diagrams are included.

Readers' Service Item L-18

"How to Use the Porter-Cable Bayonet Saw." Porter-Cable Machine Co. 26 pages. This profusely illustrated manual for builders, carpenters, Formica workers, pattern makers, and plastics processors describes the firm's new portable jig saw, including its special applications. Directions on maintenance and repair, a listing of parts and accessories, recommended cord sizes, and a list of authorized service stations are included.

Readers' Service Item L-19

"Tergitol Surface Active Agents." Carbide & Carbon Chemicals Co. 40 pages. Seven nonionic and four anionic surfactants are described, including physical properties, shipping data, and specifications. Industrial applications are covered in detail, along with performance data and methods of evaluation.

Readers' Service Item L-20

"Union Carbide Silicones for the Shell Molding Process." F-8271B. Silicones division, Union Carbide & Carbon Corp. 8 pages. Properties, preparation and handling, uses, and availability of the firm's LE-46 Silicone Parting Emulsion, Parting Solution, and Modified Silicone Stock.

Readers' Service Item L-21

"Blister and Vacuum Contour Packaging." Pyroxylin Products, Inc. 4 pages. This folder explains the above packaging methods, and the use of proxseal heat-sealing adhesives for the attachment of preformed plastic blisters and vacuum contoured skins. Distributors are listed.

Readers' Service Item L-22

"Terminal Plasticizing Nozzles." Injection Molders Supply Co. 11 pages. This folder includes data on such terminal nozzles as the polyliner, extruder screw type, ball column, pineapple, and the selecting nozzle type. Limitations are described, and prices quoted for stock models.

Readers' Service Item L-23

"The Atlas Mineral Products Co." General Catalog CC-3. Atlas Mineral Products Co. 16 pages. This bulletin describes the complete line of corrosion-proof construction materials manufactured and installed by Atlas, and lists their chemical and physical property data. A number of photographs and a two-page chemical resistance chart for cements, coatings, linings, and rigid plastics are included.

Readers' Service Item L-24

"Nopcofoam." Nopco Chemical Co. 4 pages. This illustrated folder points up the properties and current applications for this urethane foam.

Readers' Service Item L-25

"The ABC's of Modern Plastics." Bakelite Co. 48 pages. This very basic, digest-size booklet gives the layman information on the sources and production of plastics, and points out their importance in everyday living. Among the other topics covered are product development, new materials, and fabrication techniques.

Readers' Service Item L-26

"Injection Molding of Tenite Polyethylene." Eastman Chemical Products, Inc. 16 pages. This booklet contains general information about molding polyethylene, mold design, molding temperatures, injection pressure, and shrinkage. A suggested guide for correcting molding difficulties is included, together with a brief discussion of melt casting, dipping, machining, welding, heat sealing, and printing.

Readers' Service Item L-27

"Merix Anti-Static." No. 3. Merix Chemical Co. 4 pages. This descriptive catalog lists over 50 fields in which the firm's destaticizing agents removes static electricity, and gives price data.

Readers' Service Item L-28

"Injection Molding of Tenite Acetate and Tenite Butyrate." Eastman Chemical Products, Inc. 51 pages. This very comprehensive booklet deals with methods of injection molding the Tenite materials, and discusses principals of injection-mold design. Considerable attention is devoted to overcoming molding difficulties.

Readers' Service Item L-29

"Melamine Molding Compounds." American Cyanamid Co. 70 pages. Subjects covered here are physical properties, storage and handling, preforming, preheating, molds, design of molded parts, molding procedures, molding variables, finishing, and applications. Individual data sheets on all of the firm's Cymel melamine molding compounds are included; though the recent name, Cymel, is not used.

Readers' Service Item L-30

"Why Plastic Tooling?" J-925. Bakelite Co. 10 pages. This folder lists, illustrates, and describes 39 applications for plastic tooling compounds based on the company's epoxy resins.

Readers' Service Item L-31

"Ferrotron Ferromagnetic Plastics." Polypenco, Inc. 16 pages. This set of bulletins describes the materials, both in flexible rod and tape and rigid powdered iron ores. Applications include tuning cores, tank circuit dummy loads, and cup cores. Numerous graphic data are included.

Readers' Service Item L-32

"Plastics in the Home Building Industry." Bakelite Co. 16 pages. This illustrated booklet describes the plastics used in home building, and presents many ideas for utilizing plastics in this field. The text is divided into sections on foundations, framing, finishing, built-in equipment, and mechanical equipment, and is illustrated with sketches showing the plastic materials in use.

Readers' Service Item L-33

"Epocast Pastes." Bulletin EP-56-7 Furane Plastics, Inc. 2 pages. Results are given of a long-term evaluation of several epoxy resin pastes for use as sealants, adhesives, space fillers, and caulking compounds. Properties evaluated include specific gravity, shrinkage, tensile strength, compression, gel time, lap shear, and coefficient of linear expansion.

Readers' Service Item L-34

"Over 50 Years of Service through Creative Chemistry." Naugatuck Chemical Division, United States Rubber Co. 36 pages. This booklet gives an illustrated description of Naugatuck's plants, products and the latters' applications throughout industry.

Readers' Service Item L-35

"Better Lighting with Lucite Acrylic Resin." E. I. du Pont de Nemours & Co., Inc. 12 pages. A property chart and tables of spectrophotometric data, light transmittance, and reflectance data are included in this booklet. A number of applications are covered.

Readers' Service Item L-36

"Low-Temperature Flexibility in Plasticizers." Emery Industries, Inc. 4 pages. This flyer contains four property charts on Plastoleins 9058 DOZ and 9057 DIOZ.

Readers' Service Item L-37

"Epoxy Hardeners." Chemical Process Co. 2 pages. Data on mixing, pot life, curing times, stability, and toxicity are given for the firm's Dion RP-7 and RP-22 liquid hardeners. Physical properties of cured laminates are also covered.

Readers' Service Item L-38

"Facts about Dehumidification for Industrial Plants, Warehouses, Stockrooms, Laboratories, and Home Requirements." Information Bulletin #496. Abbeon Supply Co. 6 pages. This combination data sheet and illustrated catalog describes dehumidification, and the firm's units for accomplishing same.

Readers' Service Item L-39

"Nylon Molding Accessories." Injection Molders Supply Co. 8 pages. Included in this catalog are a new dehumidifying oven, annealing tanks, and stock nozzle kits, plus technical notes on nylon molding.

Readers' Service Item L-40

"Teflon—Tetrafluoroethylene Resin." No. X-74. E. I. du Pont de Nemours & Co., Inc. 19 pages. The steps for lining pipe are fully described and illustrated through a set of schematic diagrams. Specifications and performance charts are included.

Readers' Service Item L-41

News of the Societies (Cont'd. from p 468)

Reinforced Group, SPE N. Y.

"Safety in the Reinforced Plastic Shop" and "Synthetic Fibers for Reinforced Plastics" were the two topics under discussion at the June 27 meeting of SPE's New York Section, Reinforced Plastics Group. About 30 members and guests were in attendance at this, the last meeting until Fall.

J. Robert McCullough, Budd Co., opened the discussion by describing how his firm handles the problems of fire and dermatitis encountered in dealing with polyester and epoxy resins. Among the precautions followed by Budd are the following: having only a single-day's supply of material on hand in the working shop; the use of an explosion-proof room for mixing; use of large hoods to draw over-spray; no body contact with the material; and special clothing and equipment. Special protective creams, such as Curadex, are used in quantity by the epoxy handlers, and workers are removed from the area immediately on any signs of sensitivity.

Nylon, Dacron, and Orlon fibers were described as polyester reinforcements by DuPont's John G. Green. Fibers were shown in three forms: short, trimmed fibers; continuous, rope-like tows; and mechanically-bonded, non-woven mats. Abrasion resistance with synthetic-fiber laminates was reportedly good, as is the less than 1% water absorption. In addition, Orlon and Dacron laminates show little or no light degradation in tests covering almost two years. Some of the most likely advantages in applications of these laminates are thought to be chemically-resistant overlays in ducts and tanks, and epoxy filter frames. Care should be taken in fabrication, however, since hydrophobic fabrics tend toward poor adhesion.

SPI Forms New Division

A Vinyl Dispersions Division has been formed by the Society of the Plastics Industry, Inc., New York, N. Y., to bring about stable, integrated growth in the dispersions industry; develop specifications, physical test procedures, and performance standards on vinyl dispersions for eventual adoption by the industry; and evolve standards on these dispersions for both industrial and consumer application usage. The Division will also devote its efforts toward collecting and disseminating statistics and other important scientific and engineering information on vinyl dispersions, and provide considered opinions on questions affecting the industry or the public interest.

The executive committee for the Division is as follows: chairman, James Hull, Reynolds Chemical Co.; vice chairman, Audley Clarke, Chemical Products Corp.; treasurer, J. M. Perone, Wooster Finishes; Arthur B. Sherry, Stanley Chemical Co.; and Walter J. Kaufman, Watson-Standard Co. Sixteen companies are actively supporting the new Division.

Book Reviews

"Development of Heat-Resistant Paints." M. Kornbluth, Corps of Engineers, U. S. Army. Order PB 111957 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 153 pages. Price, $4.00.

This report describes the development of a ceramic frit, silicone resin-type paint capable of withstanding temperatures up to 1,400° F., without significant deterioration or loss of protective properties. Intended to reduce accelerated oxidation and rapid destruction of steel components, the paint was found to offer protection for parts such as manifolds and mufflers on automobiles which are subjected to high temperatures in oxidizing atmospheres.

Commercial heat-resistant paints were tested and found inadequate to meet the above-stated conditions. It was found that a blend of ceramic frits, pigments, and refractories at a pigment-volume concentration of 35-40% and a frit-to-pigment and refractory ratio of 3:1 was superior to the metallic powders. Procurement specifications are included in the report.

"Parallel Glass Fibre Reinforcement for Plastic Laminates." Firestone Tire & Rubber Co., for the Navy Bureau of Ordnance. Order PB 111719 from OTS, U. S. Department of Commerce, Washington 25 D. C. Paper, 32 pages. Price, $1.00.

Pilot plant production of parallel glass fiber-reinforced laminates by the Navy Bureau of Ordnance is described in this report. Materials, processes, and experiments are covered, as well as testing of edges, corners, honeycomb sandwiches, tubing, and body armor.

An emulsion binder system was developed which reportedly eliminates the need for solvents, and certain thermoplastic resins were found to improve adhesion when applied to fibers in the hot zone. Investigations of tubing and body armor indicated an even greater value for glass fiber-reinforcement than had previously been anticipated.

"Investigation and Development of High-Temperature Structural Adhesives." H. N. Homeyer, Jr., J. H. Preston, and K. L. McHugh, Connecticut Hard Rubber Co., for Wright Air Development Center. Order PB 111768 from OTS, U. S. Dept. of Commerce, Washington 25, D. C. Paper, 128 pages. Price, $3.00.

This report evaluates a number of commercially available metal-to-metal adhesives on the basis of long-time, high-temperature bonding properties. The materials tested included silicon resins, rubbers, and copolymers, as well as experimentally-compounded mixtures. Also investigated were primers, fillers, and methods of preparing metal surfaces for bonding.

It was found that shear strengths averaging over 2,000 psi. at 70° F., 700-900 psi. at 300° F., and 400 psi. at 500° F. can be obtained with unmodified resins. Most stress failures were reported as resulting from thermoplasticity of the adhesive at elevated temperatures, rather than decomposition.

Although an ideal structural adhesive for the high-temperature requirements of certain aircraft applications has not yet been developed, lap-shear tests indicated certain adhesives as showing promise. Ultimate aim of these investigations is to produce an adhesive which will resist temperatures of 700° F. for 1,200 hours.

"How to Find a Buyer for Your Invention." V. D. Angerman. Science and Mechanics Publishing Co., 450 E. Ohio St., Chicago 11, Ill. Cloth, 5 by 7½ inches, 186 pages. Price, $2.95.

Written by the editor and publisher of *Science and Mechanics* magazine, this book presents information in simple terms on when, how, and where to sell inventions. Designed to give a practical and workable method for bringing a qualified inventor together with an equally qualified and interested manufacturer, the volume should be of great value to all inventors by giving them explicit directions on methods for seeking out and contacting manufacturers with the necessary capital, production facilities, and marketing know-how to put their ideas into practice.

The inventor is told how to present his drawings, sketches, and descriptive matter in a simple and clear fashion, and the intelligent steps to take to capitalize on his development. A feature of the book is a listing of 140 manufacturers who are eager to buy inventions. This section indicates the special desires of each company and the person to contact in the firm. Of value, too, is a section giving hundreds of needed inventions in every type of business; eight tested and proven methods of selling inventions; and six methods of gaining the immediate interest of prospective buyers.

Abstracts of Important Articles

Materials

"Non-Destructive Mechanical Test for Degradation. Part I—Degradation Study," C. D. Doyle. **"Part II—Method of Test,"** C. S. Duckwald. *Modern Plastics,* 33, 7, 143 (March 1956).

A low-amplitude vibrational test proved satisfactory as a non-destructive method for measuring the decline of mechanical properties with heat-aging of a glass-cloth laminate made with a triallyl cyanurate polyester.

"Grading of Polyethylene by ZST Test," H. S. Kaufman and C. O. Kroncke, *Modern Plastics,* 33, 7, 167 (March 1956).

On the basis of data presented, the zero strength time (ZST) test may be useful for grading of polyethylene polymers. The simplicity and semi-automatic features of the test should make it applicable to product quality control.

"The Use of Infrared Spectroscopy for the Determination of the Structure of High Polymers," W. Brugel, *Kunststoffe,* 46, 2, 47 (Feb. 1956).

A discussion of the basic physics and technique for use of infra-red spectroscope for determining polymer structure. Examples of typical applications include polyethylene, polystyrene, and polyamides.

"The Prediction of Long Time Stress Rupture Data from Short Time Tests," R. H. Carey and E. T. Oskin, *SPE J.,* 12, 3, 21 (March 1956).

Three theories are described which may be applied to the prediction of long-time strength from short-time tests. These theories are the Taylor, Machlin-Nowick, and Larson-Miller equations. Relative values for rupture stress obtained by these and other methods are presented and compared.

"Non-Glass Reinforcement for Plastics," Johan Bjorksten, *SPE J.,* 12, 3, 24 (March 1956).

The use of cotton, nylon, Dacron, Orlon, asbestos, and felt as reinforcements for plastics are discussed and compared with glass.

"Epoxy-Ether Resins, a New Technology," E. G. Shur, *Modern Plastics,* 33, 8, 174 (Apr. 1956).

A discussion of the resins, their compounding, chemistry, and potential applications in paints and coatings.

"Choosing Adhesives for Plastics," Irving Skeist, *Modern Plastics,* 33, 9, 121 (May 1956).

Polymer crystallinity and solubility guide the selection of adhesives for bonding plastics to themselves and to other materials. Solubility parameters can be used to predict what solvents will make good bonding agents for any particular plastic system.

"Balsa Cores for Reinforced Plastics Structures," Richard Mark, *Modern Plastics,* 33, 9, 131 (May 1956).

Balsa woods are shown to have superior strength and fatigue properties for their weight and cost in comparison with other core materials for reinforced plastics. Properties are discussed, together with useful methods of forming balsa cores for curved structures.

"Improved Ester-Plasticized Polyvinyl Chlorides," W. F. Fisher and B. M. Vanderbilt, *Modern Plastics,* 33, 9, 164 (May 1956).

The use of oxo alcohol esters as plasticizers and bisphenol-A as an anti-oxidant in vinyl formulations is shown to result in products having excellent aging characteristics.

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines will be printed here quarterly.

The next complete listing will appear in September.

—The Editor

"Effects of Fabrication on the Properties of Teflon Resins," P. E. Thomas, J. F. Lontz, C. A. Sperati, and J. L. McPherson, *SPE J.,* 12, 6, 89 (June 1956).

Data are presented to show how fabricators can vary the properties of Teflon through their choice of fabrication conditions. Background information is given on the effects of fabrication conditions on molecular, crystalline, and gross structure. A new technique for molding inserts in Teflon is described, using the material's natural volume changes during sintering to hold the inserts in place.

"Weathering of Plastics," J. J. Gouza and W. F. Bartoe, *Modern Plastics,* 33, 9, 157 (May 1956).

A procedure is described for studying the surface deterioration, crazing, and creep deformation of plastics subjected to stress during outdoor exposure. Data are cited to show the possible failure of laboratory test results to predict outdoor service characteristics.

Equipment

"The Calculation of Roll Separating Forces in the Calendering and Milling of Plastics," F. D. Dexter and D. I. Marshall, *SPE J.,* 12, 4, 17 (Apr. 1956).

A method is described for computing these separating forces during the processing of plastics. The method makes use of the Ardichvili equation and an apparent viscosity value appropriate to the particular plastic and rolling conditions. This viscosity value is obtained by extrusion plastometer measurements. Computed separating values are shown to agree with measured values obtained in the rolling of polyethylene and plasticized vinyls.

"Use of Hydraulics for Thermoplastics Injection Molding Machines," A. Blumer, *Kunststoffe,* 46, 5, 204 (May 1956).

A description of the considerations which have led to the adoption of oil-hydraulic drives for injection machines.

"Modern Views on Extrusion Machinery," E. G. Fisher, *Trans. Plastics Inst.,* 24, 56, 143 (Apr. 1956).

This article discusses in briefer version the subjects of the two preceding papers.

"Ways of Reducing the Cost of Injection Molds," H. Gastrow, *Kunststoffe,* 46, 4, 173 (Apr. 1956).

Bad planning of mold construction leads to inflated costs which are not always immediately recognizable. Proper planning includes establishing the number of cavities and the machine performance; avoiding too-narrow tolerances; and the use of working and detail drawings.

"Cast-In Heaters," W. H. Norton, *SPE J.*, 12, 6, 28 (June 1956).

Originally presented at the SPE Conference in January, this paper describes cast heating units for use on extruders. Advantages of these units include low heat gradient, high watt density, long life, and maximum controllability.

"Stepless and 3-Position Temperature Controls for Extrusion Equipment," R. K. West, *SPE J.*, 12, 6, 81 (June 1956).

A discussion of instruments used to control electric heaters for extrusion equipment, emphasizing the importance of temperature control by zones.

Processing

"Shock Curing of Some Laminated Materials," C. A. Redfarn and J. Bedford, *Brit. Plastics*, 29, 5, 171 (May 1956).

Work is reported showing that shock curing can be accomplished successfully if the material is capable of conducting an electric current, has a high break-down temperature, and is slightly damp. The higher the voltage, the quicker the cure time. Wave curing can be accomplished, removing the necessity for platen heating.

"Chemical and Physical Problems Encountered during Manufacture and Forming of Thermoplastic Sheets and Films," H. Moritz and R. Ewald, *Kunststoffe*, 46, 5, 195 (May 1956).

A method using free torsional vibrations yields much quantitative information about the forming of thermoplastics. Tensile strength tests in the elastic range also offer opportunities for judging forming characteristics of a material.

"Vibrating Reed Test for Plastics," Stephen Strella, *ASTM Bull.*, No. 214, 47 (May 1956).

A new vibrating reed method for obtaining the dynamic modulus of solid plastics is described. This method uses electrical means to measure clamp and reed amplitudes and a mathematical system of analysis that are said to meet the objections to previous vibrating reed methods. The method is said to be rapid, accurate, and inexpensive.

"Design of Vacuum Evaporation Plant for Metallizing Plastics," L. Holland, *Trans. Plastics Inst.*, 24, 56, 153 (Apr. 1956).

The difficulties of using vacuum evaporation for the metallizing of plastic moldings are discussed in relation to the vacuum properties of the materials currently being processed. It is shown that deterioration of the system by volatiles liberated from the plastics can be prevented by using an air-ballasted rotary pump and a self-purifying diffusion pump.

"Planetary Trimming of Vacuum Formed Moldings," P. A. Sauter, *Brit. Plastics*, 29, 4, 125 (Apr. 1956).

A discussion of the latest developments in planetary trimming machines for vacuum-formed plastic parts, with emphasis on machine design and operation.

"Finishing of Polyamide Moldings. I—Test Results with Several Existing Finishing Methods," B. Olsen, *Kunststoffe*, 46, 3, 131 (March 1956).

Results of an investigation of the changes effected in polyamide injection moldings by several current industrial finishing methods.

Applications

"Epoxy Resins for Plastics Tooling," L. R. Sparrow, *SPE J.*, 12, 3, 32 (March 1956).

Production methods, formulations, and advantages of plastic tooling based on epoxy resins are discussed.

"Plastics in Water Pipes," W. D. Tiedeman, *Modern Plastics*, 33, 8, 166 (Apr. 1956).

Results of the testing program on 22 plastic pipes carried out by the National Sanitation Foundation at the University of Michigan.

"Urea-Formaldehyde Resins as Glues and Adhesives in the Processing of Wood," G. Hagen, *Kunststoffe*, 46, 2, 55 (Feb. 1956).

The urea resins have growing importance in the wood-fabricating industry. The requirements of various glue methods and of new processes are met by blends of special hardening agents and special types of Kaurit resins.

"Pipes from Low Pressure Polyethylene," K. Richard and G. Diedrich, *Kunststoffe*, 46, 5, 183 (May 1956).

Investigation of the strength characteristics of low-pressure polyethylene pipes under internal pressures applied over long periods have shown the suitability of this material for these applications. Advantages of polyethylene pipe are discussed, together with information on jointing and installation.

"Use of Foamed Plastics in Acoustics," *Kunststoffe*, 46, 5, 190 (May 1956).

A discussion of plastic foams and their use in vibration damping, sound insulating, and other acoustical applications.

"Composite Film and Pressboard for Electrical Insulation," R. Snadow and W. H. Parris, *Plastics (London)*, 21, 223, 59 (Feb. 1956).

A description of the applications in the electrical insulation field for composite flexible sheet and pressboard materials.

General

"Raw Materials in the Plastics Industry, 1945-1965," T. C. Corbett, *Trans. Plastics Inst.*, 24, 56, 113 (Apr. 1956).

A review of plastic materials production during the past 10 years, and the prediction that this general expansion can be expected to continue during the next five years, at least. Trend curves based on data for the past years are given for United Kingdom output of plastics through 1965.

"A Historical Survey of Plastics," J. H. Collins, *Trans. Plastics Inst.*, 24, 56, 100 (Apr. 1956).

A review.

"Progress Report for 1955 on the Plastics Standardization Committee (FNK) in the German Standardization Committee," A. Hochtlen and G. Ehlers, *Kunststoffe*, 46, 3, 102 (Mar. 1956).

A review.

"Technical and Economic Tasks and Aims of Standardization of Plastics," A. Hochtlen, *Kunststoffe*, 46, 3, 98 (Mar. 1956).

Standardization of plastics faces three groups of tasks; communication and ordering, simplification and testing, and specification. Classification, test methods and instruments, standards, and technical conditions of sales are discussed from these points of view. In conclusion, emphasis is placed on the importance of collaboration with other standardization bodies, both national and international.

"Quality Standards for Plastic Products," R. Nitsche, *Kunststoffe*, 46, 3, 91 (Mar. 1956).

Measures to secure maintenance of quality standards are needed, and far more work on these standards have been done in the United States than in Germany. Standardization work in Germany is discussed, together with progress to date in establishing international quality standards.

Patent Digest

Materials

Fatty Acid Esters of Epoxy Resins and Alkyl Titanates. No. 2,733,222. Harry H. Beacham, Plainfield, N. J. (to National Lead Co., New York, N. Y.).

The fluid, film-forming composition comprises an oil-modified epoxy resin made from bisphenol and epichlorhydrin.

Acrylonitrile Process and Catalyst. No. 2,734,072. Charles R. Harris, Lockport, N. Y. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Acetylene is reacted with hydrogen cyanide in the gaseous state by passage over a catalyst bed of alkali metal carbonates, hydroxides, borates, cyanides and about 0.2% bismuth.

Acrylic Esters by Formaldehyde Condensation. No. 2,734,074. Bryan C. Redmon, Baltimore, Md. (to National Distillers Products Corp., New York, N. Y.).

An anhydrous mixture of formaldehyde vapors and an alkyl ester are contacted in the presence of a dehydration catalyst heated to the reaction temperature.

Method of Producing Organic Isocyanates. No. 2,733,254. Tull C. Allen, Oxford, and David H. Chadwick, Anniston, Ala. (to Monsanto Chemical Co., St. Louis, Mo.).

This method comprises reacting a carbonyl halide such as phosgene or carbonyl bromide with a hydrohalide of a primary amine. The reaction is carried out in the presence of an inert organic solvent and a boron trifluoride catalyst. Temperatures used range upwards from 50° C.

Linear Film-Forming Polyamides Including 1,4,Diamino Cyclohexane and Process. No. 2,733,230. Hanns Ufer, Ludwigshafen, Germany (to Badische Anilin & Soda-Fabrik Aktiengesellschaft, Ludwigshafen, Germany).

The polyamide is produced by the condensation of 4.4-25% of 1,4-diaminocyclohexane with an equimolecular amount of adipic acid, epsilon-caprolactam, and hexamethylene diamine adipate.

Bookbinding Material Comprising a Vinyl Chloride Polymer and Castor Oil Maleate. No. 2,733,223. Howard A. Van Etten, Monroe, N. Y. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Particularly adapted to printing, the film comprises a mixture of castor oil maleate and a vinyl resin in the ratio of 20-60:80-40. The vinyl compound should be a homopolymer of vinyl chloride, a copolymer of vinyl chloride and vinylidene chloride, or a copolymer of vinyl chloride and vinyl acetate.

Expanded Resin and Method for Making the Same. No. 2,733,221. Steven P. Kish, Lansing, Mich. (to Kish Plastic Products, Inc., Lansing, Mich.).

An expanded, cellular, hard resin is formed by admixing 100 parts of a liquid, acid-curable phenol-aldehyde with 18-22 parts of an aqueous acidic solution, and a metal above hydrogen in the electromotive series in an amount sufficient to produce a predetermined amount of gas.

Blends of Vinyl Chloride Polymers with Ethylene/Vinylene Carbonate Copolymers. No. 2,733,228. Ival O. Salyer and James A. Herbig, Dayton, O. (to Monsanto Chemical Co., St. Louis, Mo.).

A restatement of patent title.

Plasticized Compositions. No. 2,730,513. E. J. G. Balley, Welwyn Garden City, and Wilfred Walker, Cleveleys, England (to Imperial Chemical Industries, Ltd.).

Compositions adapted for cable sheathing, calendering and extrusion comprising PVC plasticized with a material consisting essentially of the diesters of at least one polybasic acid and a mixture of mixed straight-chain primary alcohols and mixed 2-methyl substituted primary alcohols, both of these alcohols having 7-9 carbon atoms per molecule in major proportion. These alcohols are present in the relative proportions by volume of 40-50% C_7 alcohols, 50-40% C_8 alcohols, and 10-15% C_9 alcohols.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

—The Editor

Acrylonitrile Copolymers. No. 2,735,8[illegible] Maurice Louis Auguste Fluchaire and Je[illegible] Auguste Phelisse, Lyon, France. (to S[illegible] ciete des Usines Chimiques Rhone Poule[illegible] Paris, France).

The composition consists of polyacryl[illegible] nitrile and a copolymer of acrylonitri[illegible] with a vinyl ether of an amino alcoh[illegible] dispersed in a dimethylformamide medi[illegible]

Method of Producing a Resinous Condensation Product. No. 2,735,838. Rin[illegible] Dijkstra and Jelis de Jonge, Eindhove[illegible] Netherlands. (to Hartford National Ba[illegible] & Trust Co., Hartford, Conn.).

One mol of phenol is mixed with on[illegible] mol of furfural and less than 0.1 mol [illegible] an alkaline catalyst. This reaction mixtu[illegible] is heated to 120-170° C., and additiona[illegible] catalyst added. The reaction is terminate[illegible] when less than one mol of water per m[illegible] of phenol is split off.

Equipment

Masticating Head for an Extrusion Machine. No. 2,732,587. Edward S. Greene, Union, N. J.

The extruder consists of the following components: a cylinder; a adjustable-length screw feeder; a conical chamber removably secured to the cylinder's discharge end; and internally-toothed ring on the inner wall of the chamber; serrations on both sides of the ring; a coaxial, conically-shaped feeder extension which is rotatable within the chamber; a recess in this extension, adapted to accommodate the ring teeth in close proximity; and serrations in this extension on both sides of the recess.

Extruders. No. 2,732,588. Hubert A. Myers, North Riverside, Ill. (to Western Electric Co., Inc., New York, N. Y.).

This extruder comprises an extruding head with a core passage and concentric socket, the core tube having a projection extending laterally and designed to fit into this socket. An elongated draw means, slidable in the passage, has a lateral projection for engaging a projection on the shank. This locks the core tube in the socket.

Heat-Sealing of Thermoplastic Film. No. 2,732,887. Donald Ellsworth Drew, Claymont, and Walter Mead Farrelly, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

The apparatus for heat-sealing continuous tubing of thermoplastic film material comprises a cooling drum which is driven about a horizontal, fixed axis. A heated, shiftable sealing bar is positioned parallel to the horizontal axis of the drum so that it contacts the film at roughly the same point where the film first contacts the drum.

Injection Molding Machine with Automatically-Controlled Weigh-Feeder. No. 2,736,922. Warren J. Schieser and John F. Kelly, Columbus, O. (to Exact Weight Scale Co., Columbus, O.).

The machine has a ram which is movable between injecting and non-injecting positions, a weigh-feeder for supplying weighed charges to the ram, and a means for controlling the weight of successive charges.

Injection Molding Machine with Automatically-Controlled Weigh-Feeder. No. 2,736,923. Warren J. Schieser and John F. Kelly, Columbus, O. (to Exact Weight Scale Co., Columbus, O.).

Here, the ram is reciprocable between injecting and non-injecting positions. The weigh-feeder comprises a weighing scale, an electric means for feeding material to the scale, an electric means for transporting the weighed charges from the scale to the ram, and an electric compensating circuit controlled by the position of the ram.

Plastometer. No. 2,737,805. Louis G. Blumenbaum, Cranston, R. I. (to Scott Testers, Inc., Providence, R. I.).

This measuring machine includes a means for subjecting a constant volume of plastic material to a shearing action between two dies; one stationary, and the other movable. A manually-operated lever moves the second die into engagement with the first.

Extruding Machine. No. 2,738,549. Paul J. Pazitney, Jr., and Orville C. De Weese, Dayton, O. (to General Motors Corp., Detroit, Mich.).

The machine extrudes a plurality of parts from a single source of supply. It comprises a head member, a terminal member with tapering bore, a removable die plate, a valve means, a plurality of conic members, a means for removably securing the die plate, and a connecting means to the head member.

Extrusion Apparatus. No. 2,736,058. Arthur F. Dellheim, Baltimore, Md. (to National Plastic Products Co., Odenton, Md.).

The apparatus includes a barrel, an internal feeding means, a hopper, a die, an opening in the middle of the barrel, a devolatilization chamber, and a baffle.

Method and Apparatus for Forming Plastic Film and Printing It. No. 2,736,056. Henry A. Toulmin, Jr., Dayton, O. (to Commonwealth Engineering Co., Dayton, O.).

The apparatus consists of a plastic-containing tank; means for heating the tank's contents; exit aperture; and a means for directing, supporting, and hardening the continuously-extruded film. This latter means comprises gas jets arranged longitudinally so that mechanical contact with the film is avoided until hardening sets in.

Extrusion Press. No. 2,732,938. Heinrich B. Albers, Malverne, N. Y. (to Hydropress, Inc., New York, N. Y.).

This press comprises a base, a support, a means on the base for providing vertical adjustment of the support, a plate member which is vertically and longitudinally-movable in a guide means, longitudinal slots in the plate member, a flat-sided bushing, and an eccentric element.

Injection Molding Equipment. No. 2,733,479. John A. English, Yardley, Pa.

The machine consists of a die carrier with sprue passage; a plurality of gate channels, radiating from the sprue passage; a plurality of die-receiving recesses; die inserts secured within these recesses; and an ejection means projecting beyond the rear of the die carrier.

Apparatus for Welding Large Sheets of Thermoplastic Material. No. 2,735,475. Gilmore T. Schjeldahl, Farmington, Minn. (to Herb-Shelly, Inc., Farmington, Minn.).

The machine comprises a sheet-supporting and clamping table, a parallel guideway, and a traveling weld mechanism with heating element.

Extruding Apparatus. No. 2,740,988. George E. Henning, Baltimore, Md. (to Western Electric Co., Inc., New York, N. Y.).

The extruder applies a continuous plastic covering to an advancing, filamentary core. Parts include: an extrusion cylinder, stock screw rotatably mounted within the bore, extrusion head mounted at exit end of the cylinder, stationary extrusion die with tapered aperture, tapered nose with helical groove in outer periphery, and a means for rotating the core tube at uniform speed.

Processing

Process of Stiffening Felted Bodies. No. 2,737,462. Milton J. Scott, Lexington, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

Animal fiber or fur felt is adjusted to a pH below 4, and immersed in a solution with a pH between 7 and 9. The solution contains 85-99 mol percent of combined vinyl acetate, and 1-15 mol percent of an ethylenically-unsaturated aliphatic, monocarboxylic acid or anhydride. The felt is removed from the solution within two minutes, and the excess liquid extracted. The dried felt should contain .5-10% by weight of the copolymer.

Lamination of Fluorocarbons Such as Polytrifluorochloroethylene with Other Materials. No. 2,736,680. Alfred S. Kidwell, Milford, Conn. (to Connecticut Hard Rubber Co., New Haven, Conn.).

An intimate mixture of finely-divided fluorocarbon polymer and polyalkylene polysulfide rubber is spread on the surface of a sheet and fused. This sheet is then cemented to a sheet of another material and permitted to stand 24 hours at room temperature to effect cure of the rubber.

Method of Making Shell Mold Components. No. 2,736,077. Kenneth M. Bartlett, South Euclid, O. (to Thompson Products, Inc., Cleveland, O.).

Pattern material is coated with refractory particles joined by a thermosetting binder. The pattern material should have a melting point between the bonding temperature and the setting temperature of the binder. Heat is applied for a sufficient time to build up a coating, and the pattern is removed while still in liquid form.

Process for Film Casting. No. 2,736,066. William Anthony Chren, Wilmington, Del., and Charles H. Hofrichter, Jr., Madison, Conn. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Molten, thermoplastic film is extruded onto a moving, quenching surface, and stretching forces are applied. A localized jet of inert gas is directed against the upper surface of the film adjacent to the side edge only, and with sufficient force to effect firm contact between the film and the quenching surface. This causes the film edges to adhere.

Marbling Plastic Sheet. No. 2,740,991. Raymond C. Hess, Westfield, and Louis L. Carpenter and Waldemar Horstemeier, Plainfield, N. J. (to Union Carbide & Carbon Corp., New York, N. Y.).

Hot granules of plastic material are fed continuously between the top roll and the baffle, and simultaneously feeding cold slivers of colored plastic material between the offset roll and the baffle. This is done transverse to the direction of calendering.

Thermoset Synthetic Resin Laminate with Special Surface and Method of Making Same. No. 2,739,881. Charles G. Kepple, Pittsburgh, Pa. (to Westinghouse Electric Corp., East Pittsburgh, Pa.).

The surface sheet is impregnated with a synthetic resin varnish in the A-stage, and dried to a tack-free condition. A thin coating of adhesive resin is applied to the sheet, followed by a uniform layer of

finely-divided granular particles. The sheet is then dried, advancing the resin to the B-stage, and applied to a stack of resin-impregnated sheets with the granular surface exposed. The sheets are cured, and a coating of electrically-conducting metal is applied.

Method and Apparatus for Shaping Articles of Plastic Material. No. 2,734,245. John J. Chamberlain, Akron, O. (to United States Stoneware Co., Akron, O.).

A continuous plastic strip of deep channel form is longitudinally-fed and progressively bent in an arcuate path past shaping and severing positions to form repeated units.

Process for Wet-Drawing Polyethylene Terephthalate. No. 2,734,794. Joseph Gordon Calton, Buffalo, N. Y. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Uniform fibers having the resilience of better grades of wool are produced by taking polyethylene terephthalate fibers of textile dernier and spinning them at the rate of 900-1,800 yards per minute. The fibers are then wet, drawn at a temperature of 35-50° C., to a maximum draw of 4.1 and heated to 90-200° C. This relaxes the fibers and sets them in a wool-like resilience.

Method of Heat Sealing and Severing Plastic Sheets. No. 2,735,797. Gilmore T. Schjeldahl, Farmington, Minn. (to Herb-Shelly, Inc., Farmington, Minn.).

This method of reinforcing and severing a previously-formed transverse heat seal across a plurality of thermoplastic sheets consists of contacting the seal with a heated tool; melting through the sheets; and forming a molten, beaded edge at the line of sever.

Extrusion of Thermoplastic Material. No. 2,732,592. Eustace Tunnicliff, Leigh, and Roland Barlow, Accrington, England. (to British Insulated Callender's Cables, Ltd., London, England).

An insulated, electric conductor is manufactured by extruding a polyethylene cover over the conductor and passing it through three cooling zones. Temperatures range from 110° C., down.

Blending Plastics and Fluids. No. 2,733,051. Louis F. Street, Norristown, Pa. (to Welding Engineers, Inc., Norristown, Pa.).

This continuous process for plasticizing a material comprises a continuous feeding into a mixing chamber, then subjecting it to pressure forward feeding during the stirring operation. The plasticizer is added under pressure.

Method of Printing on Plastic Films. No. 2,733,180. Silvio Pinto, Long Island City, N. Y.

To print on polyvinyl films, this technique requires a design which is first printed on paper (but not penetrating into the fibers). A compatible resin is applied over the design, dried to a non-tacky state, and laminated to the vinyl film under heat and pressure. The last step involves removing the paper.

Applications

Method of Making a Plastic Boot or the Like. No. 2,736,926. Clarence E. Johnson, Jr., and Bernhardt M. Pederson, Jr., Winona, Minn. (to Plasti Industries, Inc., Winona, Minn.).

A boot mold is dipped into the plastic solution, removed, and allowed to dry until it becomes slightly tacky. Bristles are applied to the sole, and drawn away so as to give a non-directional, anti-slip surface of irregular peaks and valleys.

Spliced Fabric. No. 2,737,466. William P. Utermohlen, Jr., Moorestown, N. J., and John C. Bletzinger, Neenah, Wis. (to Kimberly-Clark Corp., Neenah, Wis.).

Two runs of a porous fabric are overlapped and heat-sealed by an unstressed, dimensionally-stable PVC-PVA film, which covers at least a portion of the overlapped area.

Antifriction Extension Rod and Track. No. 2,736,055. Ralph E. Bell, Sturgis, Mich. (to Kirsch Co., Sturgis, Mich.).

A sheet-metal curtain rod of C-shaped cross-section has a longitudinal slot comprising a pair of telescoping sections and a nylon track. This track has a longitudinal groove fitted over the sheet metal at one edge of the slot, and has resilient walls which frictionally-engage the sheet sides to retain its position.

Plastic Rain Cap Cover, Molded. No. 2,734,197. Jerry Kreinik, Brooklyn, N. Y. (to United States of America as represented by the Secretary of the Navy).

Intended for visored caps, the cover comprises a transparent, elastic material having a crown portion, an inwardly-sloping side portion, a visor portion, a head-band portion, and a double bead of plastic material joining the head-band and visor portions. Molding forms a seamless, one-piece unit, and the visor can be severed along the bead without destroying the crown portion.

Hinge Structure for Molded Boxes. No. 2,734,222. Yoneo Kiba, Chicago, Ill. (to Continental Plastics Corp., Chicago, Ill.).

The hinge includes a receptacle and cover, both having side walls in the same plane. Pintle means on the side wall of the cover have a bearing support which engages a hook on the side wall of the receptacle.

Shoe Stiffener, Including a Lamina of Polyethylene. No. 2,734,289. Walter H. Heaton, Franklin, and Ronald W. Morse, Newton, Mass. (to Beckwith Mfg. Co., Dover, N. H.).

The stiffener comprises surface sheets of cotton fabric permanently bonded to both sides of a polyethylene interply. The polyethylene is a type which is extruodable in sheet form at 40-600° F., a temperature at which the fabric becomes partially embedded in the plastic to form a composite laminate. The laminate is immediately formed to the desired contour.

Plastic Fish Bait. No. 2,735,209. Thomas G. Faulkner, Tampa, Fla.

The device has a reinforcing element shaped to represent the vertical side elevation of a fish. Molded-in elements form a hollow lure, and bosses furnish means of hook and tow-line attachment.

Snap Fit Plastic Pipe Connector Assembly. No. 2,735,699. William H. Chadbourne, Evanston, Ill. (to Danielson Mfg. Co., Danielson, Conn.).

The assembly has a central body portion with a flow passage, and a socket communicating thereto; the socket being defined by an annular flange which is integral with the body portion. The flange terminates in a conically-formed tip converging toward the free end of the flange.

Pressure-Sensitive Adhesive Tape. No. 2,733,169. Reynold E. Holmen, White Bear Township, Ramsey County, and William E. Lundquist, Savage, Minn. (to Minnesota Mining & Mfg. Co., St. Paul, Minn.).

A soluble, nitrogen-carrying polyester is mixed with a volatile, organic solvent and an aldehydic curing agent. A porous, flexible web is impregnated with this material, heated, and dried.

Hinge Structure for Molded Plastic Boxes. No. 2,732,581. Ervin R. Heck, Westmont, Ill. (to Bradley Associates, Inc., Chicago, Ill.).

An integrally-molded hinge for a pair of box sections comprises a hinge pin formed integrally on the rear wall of one of the sections and an integrally-formed hook on the rear wall of the other section. The hook has a molded-in annular channel which engages the boss on the hinge pin.

Domestic Production and Sales of Plastics and Resin Material, February and March, 1956

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of February and March, 1956. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

Cellulosics show a slight, but steady gain for the past several months. Other resins show virtually no change, but sales are up.

	February		March	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,621,351	1,655,097	1,901,079	1,790,061
Sheets, 0.003 gage and over	1,206,145	1,143,167	1,639,009	1,534,662
All other sheets, rods, and tubes	598,257	623,076	755,866	683,855
Molding and extrusion materials	7,178,343	6,959,419	8,006,700	8,078,200
Nitrocellulose sheets, rods, and tubes	496,715	467,259	500,752	487,284
Other cellulose plastics	500,659	450,217	488,173	467,895
TOTAL	11,601,470	11,298,235	13,291,579	13,041,957
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	20,279,205	16,620,349	20,351,168	17,023,536
Bonding and adhesive resins for—				
Laminating (except plywood)	5,223,052	3,913,845	6,217,508	4,454,157
Coated and bonded abrasives	1,409,304	1,303,040	1,318,262	1,387,724
Friction materials (brake linings, clutch facings, and similar materials)	1,891,214	1,635,045	1,936,105	1,734,738
Thermal insulation (fiber glass, rock wool)	4,645,642	4,783,099	4,710,665	4,667,757
Plywood	4,040,099	3,233,986	4,059,936	3,254,965
All other bonding and adhesive uses	2,591,770	2,359,361	2,772,062	2,783,492
Protective-coating resins, unmodified and modified except by rosin	2,623,757	2,255,468	2,578,165	2,346,772
Resins for all other uses	2,718,724	2,428,964	2,565,794	2,274,072
TOTAL	45,422,767	38,533,157	46,509,665	39,927,213
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	5,506,728	5,507,519	4,081,338	2,632,638
Paper-treating and paper-coating resins	2,465,351	2,005,804	1,446,578	1,873,086
Bonding and adhesive resins for—				
Plywood	9,326,232	8,442,473	9,239,321	8,172,091
All other bonding and adhesive uses, including laminating	2,058,679	1,854,021	2,018,807	1,880,948
Protective-coating resins, straight and modified	3,170,927	2,263,436	2,985,765	2,032,202
Resins for all other uses, including molding	7,150,245	6,560,088	8,374,614	7,454,247
TOTAL	29,678,162	26,633,341	28,146,423	29,573,128
Styrene Resins:				
Molding materials[1]	32,289,279	32,779,480	34,869,361	36,169,252
Protective-coating resins, straight and modified	7,650,344	8,395,073	8,825,092	8,475,312
Resins for all other uses	8,111,413	8,690,034	8,403,105	8,649,369
TOTAL	48,051,036	49,864,587	52,097,558	53,293,933
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)	— — —	6,849,224	— — —	7,388,429
Sheeting (resin content)	— — —	5,295,839	— — —	5,279,948
Molding and extrusion (resin content)	— — —	16,509,162	— — —	16,964,803
Textile and paper treating and coating (resin content)[3]	— — —	5,187,440	— — —	4,961,913
Flooring (resin content)	— — —	4,894,360	— — —	5,015,556
Protective coatings (resin content)	— — —	1,791,574	— — —	2,273,656
All other uses (resin content)	— — —	6,184,688	— — —	5,810,627
All other vinyl resins for—				
Adhesives (resin content)	— — —	2,717,816	— — —	3,161,888
All other uses (resin content)	— — —	8,696,282	— — —	9,364,277
TOTAL	61,606,746	58,126,385	66,675,061	60,221,097
Coumarone-Indene and Petroleum Polymer Resins	18,678,300	18,938,959	22,061,334	21,302,458
Polyester Resins	5,366,218	4,065,774	5,986,452	4,907,857
Polyethylene Resins	41,415,886	38,378,211	40,566,614	42,187,469
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[3] [4]	3,584,299	3,326,361	3,922,247	3,443,438
Protective-coating resins[5]	706,883	415,444	901,612	416,269
Resins for all other uses[6]	9,313,317	8,691,867	9,906,406	9,373,772
TOTAL	13,604,499	12,433,672	14,730,265	13,233,479
GRAND TOTALS	275,425,084	258,272,321	290,064,951	277,688,591

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
SOURCE: United States Tariff Commission, Chemical Division.

CALENDAR of COMING EVENTS

September 16-21
American Chemical Society's 130th National Meeting. Atlantic City, N. J.

September 17-21
Second Pacific Area National Meeting, American Society for Testing Materials. Hotel Statler, Los Angeles, Calif.

September 19
SPE New York Section. Gotham Hotel, New York, N. Y.

September 26
Reinforced Plastics Group, SPE New York Section. Tufaro's Restaurant, Corona (Queens), N. Y.

October 3
SPE Western New England Section. Bradley Field, Windsor Locks, Conn.

October 4
SPE Southern California Section. Scully's Restaurant, Los Angeles, Calif.

October 8
SPE Cleveland-Akron Section. Spanish Tavern, Brecksville, Ohio

October 10
SPE Newark Section. Military Park Hotel, Newark, N. J.

October 11-12
SPI New England Section Conference. Wentworth Hotel, Portsmouth, N. H.

October 15
SPE Detroit Section. Rackham Memorial Bldg., Detroit, Mich.
SPE Southern Section. Mammy's Shanty, Atlanta, Ga.

October 16
SPE St. Louis Section. Melbourne Hotel, St. Louis, Mo.

October 17
SPE Chicago Section. Western Society of Engineers Bldg., Chicago, Ill.
SPE New York Section. Gotham Hotel, New York, N. Y.

October 18
SPE Eastern New England Section. Hotel Beaconsfield, Brookline, Mass.
SPE Ontario Section. St. Regis Hotel, Toronto.

October 24
SPE Philadelphia Section. Franklin Institute, Philadelphia, Pa.
SPE Quebec Section. Queens Hotel, Montreal, Canada.
Reinforced Plastics Group, SPE New York Section. Tufaro's Restaurant, Corona (Queens), N. Y.

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NOTICE

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Current Market Prices

This listing is as comprehensive and up-to-date as possible. The full listing will appear quarterly, while intervening issues will carry a briefer tabulation of price changes and additions.

Companies whose products do not appear are invited to submit price data for inclusion in the listing. All suppliers are requested to submit product additions and price changes promptly as they occur, in order to make this listing of maximum value to our readers.

Prices, in general, are f.o.b. works. Ranges indicate quantity or grade variations. No guarantee of these prices is made, and spot prices should be obtained from the individual suppliers.

— The Editor

Adhesives

mpcoflex Adhesive	qt.	$2.75 /	$3.50
akelite BC—17613	lb.	.54 /	.84
BCU-40	lb.	.18 /	.48
BR-11938	lb.	.285 /	.585
Bonding resins, abrasives	lb.	.20 /	.915
Brake linings	lb.	.215 /	.6275
Foundry resins	lb.	.2075 /	.395
Heat Insul. resins	lb.	.1425/	.37
D Cement Nos. 200, 201, 202, 203, 204	qt.	$0.94 /	1.50
PS-7	qt.	2.12 /	2.90
pon Adhesive VI, VIII	lb.	3.08 /	3.30
IX	lb.	4.25 /	4.50
poxy Adhesive A-1, A-3, A-4	qt.	4.45 /	6.90
A-2, A-5	qt.	5.60 /	8.00
A-6	qt.	5.80 /	8.00
C-1, C-2, C-3, C-9	qt.	5.60 /	8.00
C-4, C-7	qt.	3.69 /	5.30
erible Resin No. 1	qt.	4.45 /	6.90
E 12316	lb.	.30 /	.39
12353	lb.	.225 /	.385
elmac 401	lb.	.45	
421	lb.	.45 /	.47
elurac 300, 302	lb.	.25 /	.29
301	lb.	.28 /	.33
etlbond 2002-14	qt.	1.84 /	5.00
4021 Type I	sq. ft.	1.43	
Type II	qt.	1.29 /	3.20
Type III	qt.	1.49 /	3.50
laskon Phenolic Bonding Resin	lb.	.16 /	.21
Urea Adhesive 530-11L	lb.	.1875/	.2175
Liquid Adhesive, 2L Types	lb.	.105 /	.115
WR Types	lb.	.0675/	.125
Spray Dried Adhesives	lb.	.18 /	.29
lastic Cement	gal.	2.25 /	2.70
liobond 20	gal.	4.50 /	7.00
30	gal.	5.25 /	8.00
olyester Foam Cement PC-232	gal.	2.40 /	2.90
chenectady SP-7401	lb.	.29 /	.31
chwartz Vinyl Cement	qt.	1.24 /	1.50
ynvarite US #1	lb.	.195 /	.215
ynvarol T	lb.	.125 /	.16
T-3	lb.	.0875/	.1225
T-15, T-15D	lb.	.1275/	.1625
TN, TUN	lb.	.1325/	.1675
TN-23	lb.	.14 /	.175
WR-513	lb.	.0875/	.1225
WR-515	lb.	.0825/	.1175
WR-520	lb.	.0625/	.0925
yrofoam Adhesive #5	gal.	3.75 /	4.75
hixens	gal.	3.30 /	9.00
rac 110	lb.	.205 /	.225
115	lb.	.24 /	.26
180	lb.	.095 /	.12
185	lb.	.1625/	.2175
186	lb.	.0875/	.1125
192	lb.	.07	

Anti-Static Agents

nstac-2M	qt.	1.75 /	2.00
ogostat	gal.	1.35 /	1.65
erix Anti-Static #79	qt.	.75 /	3.85
#79-OL	qt.	.75 /	3.85

Catalysts

dvasol	lb.	.4375/	.5375
ritemp Curing Agent 105	lb.	2.00 /	2.25
akelite BH-17618	lb.	.33 /	.63
BHU-53	lb.	.15 /	.45
ERL series	lb.	.67 /	1.195
adet benzoyl peroxide, granules	lb.	.98 /	2.00
Paste	lb.	.95 /	2.25
Powder	lb.	1.50 /	2.37
Dichlorobenzoyl peroxide	lb.	3.00 /	4.25
Lauroyl peroxide	lb.	1.90 /	3.50
Methyl ethyl ketone peroxide	lb.	1.85 /	4.00
Catalyst 57	lb.	.12	
196	lb.	.10	
C-110, -180, -180-S, C-110-S, WF-100, -101	lb.	.12	
Celanese accelerators D & E	lb.	.43 /	.50
Benzol peroxide paste	lb.	2.00	
Catalyst MC-1	lb.	2.25 /	2.50
Epon Curing Agent BF_3-400	lb.	4.00 /	4.50
C-111	lb.	.6225/	1.10
D	lb.	3.33 /	4.75
T	lb.	.80 /	1.11
U	lb.	.86 /	1.02
Z	lb.	1.265 /	1.56
Furane H-736-A	lb.	1.30 /	2.00
Hardener 157	lb.	1.00 /	1.15
175, 179, 191	lb.	.50 /	.65
181, 184, 185, 185-S, M-325	lb.	.12	
342	lb.	1.40 /	1.55
H C Promoter 6%	lb.	.5275/	.6275
12%	lb.	.9025/	1.0025
Het anhydride	lb.	.55	
HN 551	lb.	.95 /	1.40
901	lb.	.36 /	.80
951 Ciba	lb.	.82 /	1.32
951 Furane	lb.	1.30 /	2.00
IC activators		3.00	
Inhibitor	lb.	.98	
Melurac 255, 259	lb.	.35	
Modifier CB-110, WF-61	lb.	.15	
P-27	gal.	10.00	
Plaskon Hardeners, Liquid	lb.	.07	
Powdered	lb.	.10 /	.46
Spray dried	lb.	.10 /	.25
Promoter D-2	lb.	1.60 /	2.00
Quick-Set Accelerator 804	gal.	9.80	
Rezolin epoxy hardeners	lb.	1.14 /	2.50
SA Hardener	lb.	.10	
Soligen	lb.	.4825/	.5825

Coating Resins

Acryloids	lb.	.30 /	.87
Amberlacs	lb.	.2625/	.2875
Amberols, phenolic types	lb.	.2125/	.375
Rosin maleic types	lb.	.21 /	.345
Bakelite Phenolics	lb.	.28 /	.64
Styrene emulsions	lb.	.1375/	.31
Vinyl acetates	lb.	.295 /	.66
Solutions	gal.	5.10	
Alcohols	gal.	2.27 /	2.76
Butyral resins	lb.	1.04 /	1.24
Chlorides	lb.	.41 /	.61
Chloride-acetates	lb.	.38 /	.66
Modified	lb.	.44 /	.72
Celanese PVA emulsions, homopolymers	lb.	.17 /	.26
Copolymers	lb.	.19 /	.28
Chemigum latices	lb.	.46 /	.60
Cymel 243-3	lb.	.38 /	.385
245-8	lb.	.34 /	.345
247-10	lb.	.385 /	.39
248-8	lb.	.365 /	.37
Dylex K-500, -600, -700, -900	lb.	.30 /	.46
G-E 13110	lb.	.30 /	.39
G.M.I. Polyamids 100	lb.	.51 /	.64
115	lb.	.54 /	.77
Kel-F Dispersion (dry wt.)	lb.	12.00	
Ladcote FHHF-4010, FYHF-4010	lb.	.3575/	.4075
Plaskon Alkyds	lb.	.1075/	.3375
Modified	lb.	.15 /	.2625
Ester Gums	lb.	.1425/	.2475
Maleics	lb.	.1825/	.275
Melamines	lb.	.195 /	.435
Phenolics	lb.	.3925/	.475
Modified	lb.	.1825/	.29
Phenolic Laminating Varnishes	lb.	.165 /	.27
Silicone Alkyds	lb.	1.10 /	2.40
Ureas	lb.	.195 /	.435
Pliolite latices	lb.	.30 /	.39
Pliolite N R	lb.	.93 /	1.22
S-3	lb.	.42 /	.44
S-5	lb.	.49 /	.51
Milled	lb.	.54 /	.56
S-7	lb.	.88 /	1.01
Polyfluoron liquid dispersions	lb.	2.65 /	3.85
Paste dispersions	lb.	4.20 /	4.40
Primer 140	qt.	7.88 /	8.25
Schenectady Alkyds SA Type	lb.	.3575/	.38
SE Type	lb.	.3675/	1.435
SEA Type	lb.	.3575/	.38
Styrenated	lb.	.22 /	.2625
Maleics	lb.	.1725/	.23
Phenolics	lb.	.2325/	.53
Modified	lb.	.1825/	.275
Schwartz AT-25	qt.	.63 /	1.00
BK-40	gal.	3.80 /	3.95
Synvaren 631	lb.	.17 /	.25
PLS-R	lb.	.175 /	.26
Synvarite BRLD	lb.	.40 /	.46
Synvaren 631	lb.	.175 /	.21
PLS-1	lb.	.445 /	.48
PLS-2	lb.	.41 /	.445
PLS-22	lb.	.405 /	.44
PLS-A	lb.	.56 /	.595
PLS-AA	lb.	.735 /	.77
PLS-R	lb.	.765 /	.80
Synvarite BRLD	lb.	.40 /	.41
Versamid 100	lb.	.51 /	.69
115	lb.	.64 /	.82

Colors

Acheson 0100 Series Paste Dispersions:			
Blacks	lb.	.50 /	.81
Blues	lb.	.55 /	2.175
Green	lb.	2.51 /	2.69
Orange	lb.	.67 /	.85
Reds	lb.	1.08 /	1.34
White	lb.	.52 /	.70
Yellows	lb.	.57 /	.75
Advabrite M-10	lb.	2.25 /	2.40
Advance Brightener M.D.A.C.	lb.	12.00 /	15.00
Akron Chemical Colors:			
Dry blends, reds	lb.	1.08 /	1.23
Yellows	lb.	.58 /	.88
Organic colors, blues	lb.	.75 /	3.60
Greens	lb.	1.35 /	3.95
Reds	lb.	1.10 /	4.40
Yellows	lb.	2.00 /	5.00
Pastes, blues	lb.	1.25 /	1.58
Greens	lb.	1.85 /	1.90
Reds	lb.	1.10 /	1.40
White	lb.	.55 /	.60
Yellows	lb.	1.70 /	1.75
Aquablak No. 1	lb.	.1925/	.1975
B	lb.	.0975/	.1025
G, K	lb.	.12 /	.125
H	lb.	.20 /	.205
L	lb.	.14 /	.145
M	lb.	.105 /	.11
S	lb.	.1175/	.1225
U	lb.	.225 /	.23
X	lb.	.11 /	.115
Cabot carbon blacks:			
Black pearls 2	lb.	.70 /	.78
71	lb.	.32 /	.40
74	lb.	.24 /	.32
81	lb.	.084 /	.135
0	lb.	.12 /	.19
Carbolac 2	lb.	.70 /	.79
Elf 0	lb.	.12 /	.19
Elftex 3, 5, 8	lb.	.085 /	.135
Monarch 71	lb.	.32 /	.40
74	lb.	.24 /	.32
81	lb.	.095 /	.16
Sterling R	lb.	.0525/	.0925
S	lb.	.045 /	.0875
Supercarbovar	lb.	.47 /	.54
Cadmolith Reds	lb.	1.72 /	2.20
Yellows	lb.	1.12 /	1.20
Claremont 4000-series Pastes			
Blacks	lb.	.82 /	1.01
Blue	lb.	.80	
Browns	lb.	.65 /	2.30
Greens	lb.	.80 /	2.15
Orange	lb.	1.58	
Red	lb.	4.15 /	4.80
Silver	lb.	1.02	
White	lb.	.695	
Yellows	lb.	.65 /	2.87
D-Series pastes,			
Blacks	lb.	.48 /	.64
Blues	lb.	.62 /	1.57
Browns	lb.	.48 /	1.67
Golds	lb.	2.31 /	2.49
Green	lb.	1.78 /	1.88
Oranges	lb.	.71 /	4.27
Reds	lb.	1.10 /	6.36
Silver	lb.	.89 /	.91
Whites	lb.	.47 /	.60
Yellows	lb.	.56 /	3.70
K-Series pastes,			
Blacks	lb.	.56 /	.71
Blues	lb.	.89 /	1.40
Browns	lb.	.53 /	.55
Greens	lb.	.92 /	1.41
Metallics	lb.	.89 /	2.47
Orange	lb.	.86 /	4.45

Reds	lb.	.99 /	6.85
Violets	lb.	2.28 /	2.30
Whites	lb.	.59 /	.60
Yellows	lb.	.72 /	3.02
Mylar printing inks:			
Aluminum	lb.	.99	
Black	lb.	.81	
Blue	lb.	1.18	
Bronze reducing clear	lb.	.51	
Gold concentrate	lb.	1.07	
Green	lb.	1.27	
Hi-viscosity clear	lb.	.69	
Orange	lb.	.97	
Pearlescent concentrate	lb.	1.98	
Red	lb.	1.19	
Reducing clear	lb.	.68	
White	lb.	.53	
Yellows	lb.	.83 /	1.21
RP Series inks	lb.	.49 /	1.87
PX Series pastes	lb.	.91 /	2.60
UR-Series pastes:			
Black	lb.	1.00	
Blue	lb.	1.82	
Brown	lb.	2.00	
Green	lb.	2.20	
Orange	lb.	1.68	
Reds	lb.	1.92 /	3.55
White	lb.	.83	
Yellows	lb.	1.75 /	2.15
Coloidex No. 3	lb.	.24	
Columbian Carbon bone blacks:			
Ivo No. 1	lb.	.1975/	.2075
3	lb.	.1875/	.1975
4	lb.	.16 /	.17
100	lb.	.2075/	.2175
359	lb.	.2025/	.2125
457	lb.	.1925/	.2025
Columbian Carbon colloidal dispersions:			
Coacetateblak CQ-21	lb.	.875 /	.90
CoblacDD Sol, Industrial	lb.	.70 /	.725
Coethlobiak CK	lb.	1.00 /	1.025
Coresinblak No.3	lb.	.76 /	.785
Costyreneblak CJ-21	lb.	.5425/	.5675
Covarnishblak AR	lb.	.60 /	.625
BJ	lb.	.50 /	.525
BK	lb.	.53 /	.555
Covinylblak BA	lb.	.95 /	.975
BD	lb.	.97 /	.995
BF	lb.	.70 /	.725
BH	lb.	.66 /	.685
BL	lb.	.82 /	.845
BM	lb.	.77 /	.795
CA-18	lb.	1.0725/	1.0975
Cowaxblak BV-25	lb.	.515 /	.54
CB-18	lb.	.5875/	.6125
CM-83	lb.	.485 /	.51
Cyanamid dyes, calcozines	lb.	.81 /	5.57
Nigrosines and indulines	lb.	.59 /	.97
Oils	lb.	.62 /	7.29
Inorganic pigments			
Blues, cobalt	lb.	.305 /	.35
Iron	lb.	.50 /	.52
Ultramarine	lb.	.165 /	.19
Greens, chrome	lb.	.39 /	.45
Oranges, chrome	lb.	.335	
Molybdate	lb.	.465	
Yellows, chrome	lb.	.335	
Zinc	lb.	.275	
Organic pigments			
Blues, alkali, dry	lb.	2.20	
Flushed	lb.	1.17 /	1.25
Molybdated & tungstated	lb.	2.60 /	6.10
Phthalocyanine	lb.	.90 /	3.60
Cadmium lithopones, reds	lb.	2.29 /	3.77
Yellows	lb.	1.12 /	1.15
Greens, mol. & tung.	lb.	3.20 /	6.20
Phthalocyanine	lb.	1.71 /	3.95
Oranges	lb.	.70 /	3.00
Reds, bon	lb.	1.50 /	2.00
Chlorinated	lb.	1.20	
Lithols	lb.	.90 /	3.95
Naphthols	lb.	.80 /	3.60
Paras	lb.	1.10	
Rhodamines	lb.	4.45 /	6.40
Toluidines	lb.	1.62 /	1.65
Violets	lb.	.75 /	4.15
Yellows	lb.	.62 /	2.35
DC Globak	lb.	.77 /	.795
DCY Coblac	lb.	.83 /	.855
Ferro blues, browns, greens	lb.	.90 /	2.96
Reds	lb.	2.93 /	4.75
Yellows	lb.	.91 /	2.90
Hiblak AE	lb.	.095 /	.10
Interchemical IC Series			
Black	lb.	.56	
Blues	lb.	.75 /	2.10
Browns	lb.	.64 /	.69
Greens	lb.	.90 /	.99
Oranges	lb.	.78 /	.89
Reds	lb.	1.16 /	2.50
White	lb.	.70	
KYellows	lb.	.95 /	1.65
entucky inorganics, orange	lb.	.44 /	.64
Yellows	lb.	.31 /	.66
Organics, blues	lb.	3.00 /	4.15
Greens	lb.	3.50 /	4.60
Purple	lb.	1.85 /	2.05
Reds	lb.	1.95 /	3.85
Kriegr-O-Dip W Types	qt.	2.63 /	7.80
A Types	qt.	1.52 /	2.25
Laminac color pastes	lb.	.76 /	1.90
Mapico colors, black	lb.	.1425/	.145
Browns	lb.	.1525/	.155
Reds	lb.	.1375/	.14
Tans	lb.	.2275/	.23
Yellows	lb.	.115 /	.1225
Mearlmaid Pearls	lb.	14.00 /	25.00
Nacromer Pearls, Series C	lb.	2.15 /	2.25
Series W	lb.	1.50 /	1.60
Pearl Essence, nat	lb.	15.00 /	30.00
Synthetic #100	lb.	1.95	
#300	lb.	1.45	
#600, #900	lb.	2.15 /	2.45
Plastics Color Co., GP colors	lb.	.65 /	3.80
Polyester pastes	lb.	.80 /	2.05
Pliolite S-5 bases with pigment			
Blacks	lb.	.44 /	.49
Blues	lb.	.62 /	1.48
Greens	lb.	.54 /	.58
Oranges	lb.	.61 /	.63
Reds	lb.	.31 /	1.20
Whites	lb.	.42 /	.44
Yellows	lb.	.43 /	.45
PMS polyester colors	lb.	.85 /	2.85
Polystyrene colors	lb.	.65 /	4.30
Polysupra polyethylene blues	lb.	.65 /	5.60
Blacks	lb.	.50 /	.80
Browns	lb.	1.48 /	3.30
Greens	lb.	1.82 /	3.55
Ivory	lb.	.65 /	1.00
Purples	lb.	2.10 /	3.30
Reds	lb.	.70 /	6.30
Silver	lb.	1.50 /	2.95
White	lb.	.60 /	.85
Yellow	lb.	1.45 /	4.25
Polystyrene blues	lb.	.50 /	9.20
Blacks	lb.	.50 /	5.30
Browns	lb.	.95 /	2.55
Greens	lb.	.35 /	7.40
Ivory	lb.	.85 /	1.20
Reds	lb.	.35 /	6.40
White	lb.	.60 /	1.05
Yellows	lb.	1.45 /	2.95
R-B-H Plastic Powders:			
Blacks	lb.	.71 /	.79
Blues, iron	lb.	.875	
Phthalocyanines	lb.	2.73	
Browns	lb.	.61 /	.87
Greens, chrome	lb.	.855	
Phthalocyanines	lb.	2.34	
Orange	lb.	.87	
Purple	lb.	3.00	
Red	lb.	1.93	
Whites	lb.	.71 /	.74
Yellow	lb.	.81	
Resin Plasticizer Pastes:			
Blacks	lb.	.505 /	.65
Blue	lb.	1.59	
Green	lb.	1.58	
Orange	lb.	.665	
Reds	lb.	1.15 /	2.24
White	lb.	.50	
Yellows, cadmium	lb.	1.20	
Chrome	lb.	.545	
Vinyl Extrusion Chips:			
Blacks	lb.	.975 /	1.04
Blues, iron	lb.	.90 /	1.08
Phthalocyanine	lb.	2.50	
Brown	lb.	.86	
Green, chrome	lb.	.96	
Phthalocyanine	lb.	2.51	
Oranges	lb.	.875 /	.92
Purple	lb.	3.41	
Reds	lb.	1.38 /	2.02
White	lb.	.78	
Yellow	lb.	.845	
R-C blacks	lb.	5.50 /	21.30
Browns	lb.	4.375 /	15.75
Reds	lb.	.28 /	15.05
Yellows	lb.	3.60 /	14.05
Rez-N-Dye (dry wt.)	lb.	7.50	
Saran colors	lb.	.59 /	1.80
Sherwin-Williams Dispersed Colors	lb.	.55 /	1.97
Inorganic colors, oranges, yellows	lb.	.32 /	.45
Organic colors, blues	lb.	.90 /	3.60
Greens	lb.	1.35 /	3.95
Reds	lb.	.85 /	4.40
Yellows	lb.	.55 /	1.97
Stan-Tones, blues, cadmium dry	lb.	1.95 /	2.15
Dry	lb.	.90 /	5.00
GPE	lb.	1.90 /	2.57
MBS	lb.	1.55 /	4.62
PC	lb.	1.80 /	1.92
Brown, GPE	lb.	3.00	
Greens, dry	lb.	.82 /	3.95
GPE	lb.	3.00 /	4.57
MBS	lb.	1.55 /	3.42
PC	lb.	2.20 /	2.25
Maroon, dry	lb.	5.50	
Oranges, cadmium dry	lb.	2.23 /	5.05
Paste	lb.	2.65 /	3.65
GPE	lb.	1.20 /	4.42
MBS	lb.	2.75 /	2.82
PC	lb.	.75 /	3.25
Reds, cadmium dry	lb.	2.49 /	6.15
Paste	lb.	3.35 /	3.95
Dry	lb.	.85 /	4.60
GPE	lb.	1.65 /	3.00
MBS	lb.	1.00 /	3.60
PC	lb.	1.10 /	3.57
Yellows, cadmium dry	lb.	2.80 /	3.18
Paste	lb.	1.63 /	2.19
Dry	lb.	.62 /	2.35
GPE	lb.	2.00 /	4.57
MBS	lb.	1.30 /	2.27
PC	lb.	1.65 /	3.57
Unitane O	lb.	.245 /	.255
OR	lb.	.265 /	.275
Vansul Organic Drys			
Blues	lb.	3.45 /	3.6
Greens	lb.	1.35 /	3.9
Oranges	lb.	2.21 /	3.9
Reds	lb.	.90 /	4.4
Yellows	lb.	2.00 /	2.2
VAP Dry Dispersions	lb.	1.00 /	4.4
VP-Series Pastes			
Black	lb.	.70	
Blue	lb.	1.65	
Brown	lb.	1.55	
Green	lb.	2.05	
Oranges	lb.	.80 /	2.3
Reds	lb.	1.15 /	2.2
White	lb.	.47 /	.4
Yellows	lb.	.60 /	1.6
VPE-Series Pastes			
Black	lb.	.90	
Blue	lb.	1.85	
Green	lb.	2.10	
Orange	lb.	1.00	
Reds	lb.	1.45 /	2.2
White	lb.	.90	
Yellows	lb.	1.60 /	2.0
VY Chips			
Blacks	lb.	.90 /	1.3
Blues	lb.	1.00 /	2.2
Brown	lb.	1.60	
Greens	lb.	.90 /	2.4
Oranges	lb.	1.00 /	2.1
Reds	lb.	1.40 /	2.7
White	lb.	.65	
Yellows	lb.	.85 /	1.8
Vinylized colors, blacks, whites	lb.	.755	
Blues	lb.	1.16 /	1.1
Golds	lb.	1.51 /	1.5
Green	lb.	1.45	
Metallic	lb.	1.15	
Orange	lb.	.83	
Reds	lb.	1.15 /	2.2
Yellows	lb.	.76 /	1.0
Violite 199, green	lb.	2.95	
200, yellow	lb.	3.75	
PL 3–60, blue	lb.	3.25	
18–70, blue	lb.	3.70	
Williams colors & pigments:			
Blacks, iron oxide	lb.	.1425/	.14
Browns, iron oxide	lb.	.1525/	.15
Burnt umbers	lb.	.0775/	.09
Greens, chromium oxide	lb.	.42 /	.48
Reds, 100 series, 1,000 series, RY series	lb.	.1375/	.14
Kromas	lb.	.1375/	.15
Yellows, iron oxide	lb.	.115 /	.12
Witcoblaks	lb.	.075 /	.37
Zopaque, anatase	lb.	.225 /	.23
Rutile	lb.	.245 /	.25

Dispersing Agents

Daxads	lb.	.08 /	.40
Tamol 731	lb.	.185 /	.18

Fillers

Advaresin CXF	lb.	.49 /	.55
KF	lb.	.38 /	.44
A. F. D.	ton	26.50 /	60.00
Albacar 5950, 5960, 5970	ton	50.00 /	55.00
Aluminum Flake	ton	23.50 /	30.00
Anhydrous calcium sulfate, W-1320	ton	47.00 /	52.00
ASP 400	ton	24.00	
ASP 1300	ton	70.00	
Atomite	ton	32.50	
Barytes, No. 1	ton	45.00 /	65.75
Burgess Iceburg Pigment	ton	50.00	
Pigment No. 30	ton	37.00	
Cab-o-sil	lb.	.68 /	.75
Calcene NC	lb.	.036 /	.059
Calcene NC	lb.	.036 /	.059
TM	lb.	.0375/	.062
Camel—CARB	ton	12.00	
—TEX	ton	20.00	
—WITE	ton	32.50	
Cotton flocks	lb.	.12 /	.32
Crown Clay	ton	14.00	
Dixie Clay	ton	14.00 /	34.50
Duramite	ton	20.00	
Edgar ASP 200	ton	43.00	
900	ton	18.50	
1300	ton	80.00	
Harwick fillers:			
Clays, Champion	ton	14.00	
Harwick	ton	14.50 /	57.00
Flock, white	lb.	.11 /	.28
Colored	lb.	.11 /	.19
Magnesium carbonate	lb.	.105 /	.13
Magnesia, tech.	lb.	.105 /	.12
Mica, Silversheen	lb.	.08 /	.085
Pecan shell flour	ton	80.00 /	100.00
Stan white 325	ton	10.50 /	12.00
Walnut shell flours:			
100W, 200WD	ton	46.00 /	56.00
100WD	ton	40.00 /	50.00
200W	ton	56.00 /	66.00
200WB	ton	59.00 /	69.00
325W	lb.	70.00 /	80.00
Hi-Sil 101	lb.	.10 /	.153
233	lb.	.09 /	.105
Hydrite	ton	22.50	
Flat	ton	22.50	
PD-10	ton	46.50	
Kalite	ton	50.00 /	65.00
Kaolloid	ton	10.50	

...minar	lb.	.015	
...dglite	lb.	.2525/	.26
...rinco	lb.	.105 /	.13
...Mamee Clay	ton	13.50 /	33.00
...ltiflex MM	ton	110.00 /	125.00
...tal 200L	ton	27.00 /	50.00
...00	ton	37.00 /	60.00
...co Clay	ton	12.00	
...ne EF	lb.	.06 /	.105
...o-Brite Clay	ton	12.50	
...owflake	ton	20.00	
...rmite	ton	80.00 /	105.00
...rtex MM	ton	37.00 /	52.00
...spenso	ton	33.00 /	48.00
...mms Satin Talc	ton	22.50 /	46.00
...Velveteen R Silica	ton	23.00 /	28.00
...arcarb P	ton	110.00 /	140.00
...R	ton	120.00 /	150.00
...Regular	ton	56.75 /	85.00
...ollastonite F-1	ton	23.00 /	25.00
...P-1	ton	25.00 /	27.00

Finishes

...ogoquant colors	gal.	3.25 /	6.30
...by gloss, acetate	gal.	2.35 /	4.30
...Metal	gal.	2.45 /	4.10
...Polystyrene	gal.	2.45 /	4.70

Flame-Proofing Agents

C-776 Antimony Concentrate	lb.	.495 /	.51
M&T Antimony oxide	lb.	.27 /	.285

Glass Reinforcements

Chrome 60-end Roving:			
FBF-7.1, -7.3	lb.	.40 /	.44
FBF-7.5, -7.7	lb.	.42 /	.46
Garan 60-end Roving:			
FBF-7.2, -7.4	lb.	.42 /	.46
FBF-7.6, -7.8	lb.	.44 /	.48
Vitron 60-end Roving:			
VR-12	lb.	.48 /	.52

Lubricants

Advawax 280	lb.	.365 /	.39
Baselube	qt.	2.50 /	4.00
DC-36 Emulsion	lb.	1.36 /	2.50
Garalease 915	gal.	3.80 /	4.50
HSC #35, 362, 515	lb.	1.22	
LC-500	gal.	2.50	
-571	gal.	3.25	
-793-10	gal.	3.40	
Lunn-Lease	gal.	4.15 /	4.85
M-1 Mold Release	lb.	3.00 /	4.00
Metasap barium stearate	lb.	.37 /	.42
Calcium 627	lb.	.36 /	.41
Stearate	lb.	.35 /	.40
Magnesium stearate	lb.	.38 /	.43
ML-4 Separating Film	lb.	.30 /	.40
Mold-Ease Concentrate			
PCR	qt.	2.50 /	5.85
Mold Release 225	gal.	5.25 /	6.00
235	gal.	6.00	
Mold-Wiz	gal.	4.00 /	6.00
Part-A-Part	gal.	3.05 /	3.75
Partingkote 823	qt.	1.18 /	2.18
Prepcxy	gal.	7.20 /	12.80
Plaskon 8406, 8407	lb.	.30 /	.37
8416, 8417	lb.	.35 /	.42
8429	lb.	.40 /	.47
Releasor Wax No. 826	lb.	2.29	
Slide	20 oz.	1.25 /	2.00
Sprits	lb.	1.00 /	1.25
SS-452	gal.	2.80 /	4.90
Super King Bomb-Lube	20 oz.	1.75 /	2.50
Toplube	qt.	2.50 /	4.00
Vibrin-VPA Parting Agent	gal.	4.25 /	4.65

Mica

Mycalex 385 & 400, rods, 18 in. length	.90 /	3.35
Sheets, 14 x 18 inches	5.70 /	22.40
K, rods, 18-in. length	1.80 /	6.70
Sheets, 14 x 18 inches	11.40 /	44.80
Supramica 500, rods, 18-in. length	1.08 /	4.02
Sheets, 14 x 18 inches	6.84 /	26.88

Miscellaneous

Dutch Boy Bentone	lb.	.44 /	.60
Ben-A-Gel	lb.	.98 /	1.40
Metasap Water Proofing Agent 569	lb.	.21	
PMS Purging Compound	lb.	.35	
Ultra violet absorber #9	lb.	5.25 /	5.75

Plasticizers

Adipol 2EH, 10A, 810, XX	lb.	.40 /	.435
BCA	lb.	.43 /	.455
ODY	lb.	.45 /	.485
Admex 710	lb.	.325 /	.35
711	lb.	.345 /	.37
744, 745	lb.	.40 /	.425
Akron MP	lb.	.305 /	.0755
Battett dibutyl phthalate	lb.	.30 /	.335
Dimethyl phthalate	lb.	.275 /	.315
Plastixizer 136	lb.	.19 /	.235
Benzoflex 2-45	lb.	.26 /	.29
9-88	lb.	.32 /	.35
Cabflex DDA, Di-OA, DOA, ODA	lb.	.425 /	.455
DDP, Di-OP, DOP, ODP	lb.	.305 /	.335
Di-BA	lb.	.4325/	.4625
Di-OZ	lb.	.48 /	.51
HS-10	lb.	.44 /	.47
TCP	lb.	.345 /	.375
Chlorowax 40	lb.	.1525/	.1825
50	lb.	.1675/	.1875
70	lb.	.185 /	.25
70-S	lb.	.21 /	.275
LV	lb.	.1725/	.2025
Columbian Carbon butyl stearate	lb.	.2275/	.3125
Capryl alcohol	lb.	.195 /	.295
Caprylene	lb.	.06 /	.16
Dibenzyl sebacate	lb.	.88 /	.965
Dibutyl phthalate, dihexyl phthalate	lb.	.30 /	.39
Dibutyl sebacate, CP	lb.	.64 /	.725
Dicapryl adipate, dihexyl adipate	lb.	.42 /	.51
Dicapryl phthalate	lb.	.295 /	.38
Dicapryl sebacate, dioctyl sebacate	lb.	.58 /	.665
Dihexyl sebacate	lb.	.62 /	.705
Diisooctyl phthalate, dioctyl phthalate	lb.	.305 /	.395
Dimethyl sebacate	lb.	1.25 /	1.335
Harchemex	lb.	.24 /	.34
Harflex 300	lb.	.5? /	.67
500	lb.	.315 /	.405
Methyl hexyl ketone	lb.	.26 /	.36
Sebacic acid, CP	lb.	.67 /	.79
Purified	lb.	.59 /	.71
Conoco H-300	lb.	.06 /	.10
Darex DIBA	lb.	.4325/	.4625
DIBM	lb.	.32 /	.3475
DIBP	lb.	.30 /	.33
DODA, DIOA	lb.	.425 /	.455
DIDP, DIOP, DOP, DOP-HR, IOIDP	lb.	.305 /	.335
Dinopol 235	lb.	.355 /	.385
IDO	lb.	.305 /	.335
MOP	lb.	.325 /	.355
Dow Plasticizer No. 5	lb.	.315 /	.54
Resin 276-V2,-V9	lb.	.265 /	.325
Drapex 3.2	lb.	.40 /	.49
Dutch Boy Plasticizer NL-A10 (DBP)	lb.	.30	.33
NL-A20 (DOP), NL-A30 (DIOP)	lb.	.305 /	.335
NL-C20 (DOS)	lb.	.61 /	.63
NL-F21	lb.	.395 /	.425
NL-F31	lb.	.44 /	.47
NL-F41	lb.	.48 /	.51
NL-A54	lb.	.295 /	.325
Elastex, 10-P, 18-P, 28-P, 90-P	lb.	.305 /	.34
20-A, 60-A	lb.	.40 /	.435
40-P	lb.	.27 /	.305
50-B	lb.	.265 /	.30
80-P	lb.	.295 /	.33
DCHP	lb.	.59 /	.605
Ethox	lb.	.50 /	.525
Flexol 3GH	lb.	.44 /	.46
3G0	lb.	.53 /	.55
4G0	lb.	.325 /	.355
8N8	lb.	.355 /	.385
10-10, 810, CC-55, DOP	lb.	.305 /	.335
10-A, A-26	lb.	.425 /	.455
77-G, 426	lb.	.27 /	.30
B-400	lb.	.25 /	.28
R2H	lb.	.59 /	.595
T0F	lb.	.435 /	.475
Flexricin 66	lb.	.3275	
P-4		.30	
P-6	lb.	.37	
P-8	lb.	.32	
Good-rite GP-233, -235, 236	lb.	.40 /	.55
GP-261, -265, -266	lb.	.305 /	.455
Harflex 10	lb.	1.25 /	1.335
40	lb.	.64 /	.725
50, 80	lb.	.58 /	.665
60	lb.	.62 /	.705
90	lb.	.88 /	.965
120, 150	lb.	.305 /	.395
140, 160	lb.	.30 /	.39
180	lb.	.295 /	.38
220, 250	lb.	.425 /	.515
260, 280	lb.	.42 /	.51
300	lb.	.58 /	.67
500	lb.	.315 /	.405
Harchem butyl stearate	lb.	.2275/	.3125
Sebacic acid, CP	lb.	.67 /	.79
Purified	lb.	.59 /	.71
Kapsol	lb.	.3225/	.3525
KP-23	lb.	.29 /	.32
-90	lb.	.40 /	.435
-140	lb.	.46 /	.485
-201	lb.	.5825/	.5925
-220	lb.	.31 /	.345
-555	lb.	.46 /	.485
Kronisol	lb.	.33 /	.365
Kronitex AA, I, K-3, MX	lb.	.345 /	.38
Methox	lb.	.385 /	.41
Monoplex DBS	lb.	.64 /	.665
DCP	lb.	.2925/	.32
DOS	lb.	.58 /	.605
S-38	lb.	.215 /	.24
S-70	lb.	.3925/	.42
S-71	lb.	.45 /	.475
Monsanto dibutyl phthalate	lb.	.30 /	.33
Diethyl phthalate	lb	.25 /	.28
Dimethyl phthalate	lb.	.275 /	.305
Diphenyl phthalate	lb.	.5175/	.5375
DIDA, DOA	lb.	.425 /	.455
DIDP, DIOP, DOP	lb.	.305 /	.335
HB-20	lb.	.15 /	.17
HB-40	lb.	.22 /	.24
Orthonitrobiphenyl	lb.	.13 /	.15
Tricresyl phosphate	lb.	.33 /	.36
Triphenyl phosphate	lb.	.39 /	.40
Morflex P-50	lb.	.68 /	.71
Naugatuck decylbutyl phthalate	lb.	.27 /	.[illegible]
Dibutyl phthalate	lb.	.30 /	.33
Sebacate	lb.	.645 /	.67
Diisooctyl adipate, dioctyl adipate	lb.	.425 /	.455
Diisooctyl phthalate, dioctyl phthalate, Isooctyl decyl phthalate	lb.	.305 /	.335
Dinonyl adipate	lb.	.445 /	.475
Dioctyl sebacate	lb.	.585 /	.61
Epoxy plasticizer	lb.	.335 /	.36
Tricresyl phosphate	lb.	.345 /	.375
Ohio-Apex butyl oleate	lb.	.2325/	.265
Stearate	lb.	.22 /	.255
Diallyl phthalate	lb.	.49 /	.525
Dibutyl phthalate	lb.	.30 /	.335
Di-Carbitol phthalate	lb.	.40 /	.425
Diisobutyl adipate	lb.	.41 /	.445
Diisodecyl phthalate	lb.	.305 /	.34
Dioctyl phthalate	lb.	.305 /	.34
D.I.O.P.	lb.	.305 /	.34
Tributyl phosphate	lb.	.50 /	.535
Ohopex Q-10	lb.	.295 /	.33
R-9	lb.	.3525/	.3775
Paraplex 5-B	lb.	.29 /	.3475
AL-111	lb.	.32 /	.3275
G-20	lb.	.76 /	.7675
G-25	lb.	.76 /	.77
G-40	lb.	.4825/	.51
G-50	lb.	.39 /	.4175
G-53	lb.	.4325/	.46
G-60, -61	lb.	.3325/	.36
G-62	lb.	.3525/	.38
RG-2	lb.	.41 /	.6575
RG-7	lb.	.33 /	.335
RG-8	lb.	.505 /	.5125
RG-10	lb.	.52 /	.5275
Pfizer acetyl tributyl citrate, tech	lb.	.32 /	.57
Acetyl triethyl citrate, tech.	lb.	.36 /	.57
Triethyl citrate	lb.	.4575/	.58
Plasticizer 1	lb.	1.17 /	1.37
Plasticizer 120	lb.	.44 /	.49
Plastoflex #3	lb.	.52 /	.57
#520	lb.	.36 /	.435
D B E	lb.	.50 /	.55
MGB	lb.	.29 /	.37
VS	lb.	.3575/	.3975
Plastolein 9050 DHZ	lb.	.52 /	.56
9055 DGP	lb.	.28 /	.32
9057 DIOZ	lb.	.455 /	.50
9058 DOZ	lb.	.455 /	.50
9250 THFO	lb.	.3575/	.4025
9404 TGP	lb.	.3725/	.4175
9715 & 9720 Polymeric	lb.	.365 /	.41
Polycizer 162, 562, 662	lb.	.305 /	.335
332, 532, 632	lb.	.40 /	.43
Polycon #7, 9, 10, 11	lb.	.305 /	.335
#30	lb.	.30 /	.33
#31	lb.	.27 /	.30
#40	lb.	.245 /	.275
PX-104	lb.	.30 /	.33
-108, -118, -120, -138	lb.	.305 /	.335
-114	lb.	.27 /	.30
-208, -220, -238	lb.	.425 /	.455
-404	lb.	.645 /	.67
-438	lb.	.585 /	.61
-800	lb.	.325 /	.35
-917	lb.	.33 /	.36
Pycal 40	lb.	.3875/	.4375
60	lb.	.60 /	.635
62	lb.	.80 /	.835
94	lb.	.3275/	.3775
140	lb.	.35 /	.40
170	lb.	.275 /	.325
194	lb.	.2775/	.3275
R C Plasticizers:			
B-17	lb.	.21 /	.33
BD-8	lb.	.38 /	.50
BIDP	lb.	.27 /	.42
DBP	lb.	.30 /	.44
DIDA, DIOA, DOA	lb.	.425 /	.56
DIDP, DIOP, DOP, ODP	lb.	.305 /	.45
DIOS, DOS	lb.	.58 /	.71
O-16	lb.	.275 /	.395
TG-8	lb.	.31 /	.43
TG-9	lb.	.41 /	.53
Santicizer 1-H	lb.	.50 /	.51
3	lb.	.46 /	.47
8	lb.	.43 /	.44
9	lb.	.39 /	.42
140	lb.	.33 /	.36
141	lb.	.34 /	.37
160	lb.	.25 /	.28
601	lb.	.32	
602	lb.	.305	
B-16	lb.	.4875/	.4975
E-15	lb.	.5075/	.5375
M-17	lb.	.4275/	.4575
Staflex AX	lb.	.43	
BR	lb.	.26 /	.29
CP	lb.	.28 /	.31
DBES, DOS	lb.	.61 /	.635
DIOA, ODA	lb.	.435 /	.465
DIOP, DOP, MP	lb.	.305 /	.335

DOZ	lb.	.48 /	.5075
IXA	lb.	.32 /	.35
KA	lb.	.36 /	.3875
KD	lb.	.44 /	.4675
Witcizer #100	lb.	.26 /	.27
#101	lb.	.31 /	.32
#200	lb.	.195 /	.205
#201	lb.	.235 /	.245
#300	lb.	.30 /	.33
#312, 313	lb.	.305 /	.33
#412	lb.	.435 /	.465

Resins & Molding Compounds

Acrylic

Cadco cast rods	lb.	1.42 /	6.96
Polished	lb.	1.58 /	7.16
Machined rods	ft.	22.00 /	89.54
Tubes	lb.	1.39 /	5.76
Polished	lb.	1.51 /	5.99
Colors	lb.	1.62 /	5.99
Pearl	lb.	1.99 /	6.76
Lucite injection molding powders:			
Colorless, transparent	lb.	.55	
Std. colors	lb.	.59 /	1.00
Stock colors	lb.	.59 /	.84
Granular Powders for compression & extrusion	lb.	.51 /	.75
Plexiglas molding powders:			
Colorless	lb.	.55 /	.80
Colors, stock	lb.	.59 /	.84
Custom	lb.	.59 /	1.00
Sheets, Types I-A & II			
Colorless	sq. ft.	.80 /	22.18
Colors	sq. ft.	.88 /	1.10
Type R, Colorless	sq. ft.	.60 /	12.64
Colors	sq. ft.	.69 /	1.07
Polycast 1	sq. ft.	.80 /	2.40

Alkyd

Plaskon foundry resin 580-11L	lb.	.245 /	.275
Molding Compound,			
Type 411	lb.	.43 /	.60
Type 413, 417	lb.	.57 /	.74
Type 420 black	lb.	.44 /	.695
Type 422 colored	lb.	.51 /	.695
Mottle	lb.	.52 /	.705
Natural	lb.	.49 /	.60
Type 430	lb.	.34 /	.50

Cellulosic

Cellulose acetate:			
Ampacet Group I	lb.	.50 /	.59
Group II	lb.	.46 /	.55
Group III			
Colors	lb.	.50 /	.59
Metallic	lb.	.63 /	.71
Pearl	lb.	.59 /	.68
Phosphorescent	lb.	.80 /	.89
Celanese film rolls			
Clear	lb.	.64 /	.87
Colors	lb.	.88 /	1.74
Sheets			
Clear	M. sq. in.	.032 /	.107
Colors	M. sq. in.	.042 /	.141
Forticel, plain colors	lb.	.63 /	.71
Reprocessed blacks	lb.	.51 /	.58
Lumarith molding cmpds.,			
Group I	lb.	.50 /	.59
Group II	lb.	.46 /	.55
Group III	lb.	.36 /	.45
Sheeting, extruded, non-stock			
Clear	M. sq. in.	.14 /	1.89
Colors	M. sq. in.	.16 /	2.07
Stock, clear	M. sq. in.	.14 /	1.62
Colors	M. sq. in.	.16 /	1.62
Cast, rolls			
Matte	M. sq. in.	.179 /	.648
Tinted	M. sq. in.	.239 /	.708
Sheets, clear	M. sq. in.	.141 /	1.52
Matte	M. sq. in.	.203 /	.788
Tinted	M. sq. in.	.255 /	1.72
Hercocel A, extrusion & injection	lb.	.50 /	.65
Injection, std. colors	lb.	.46 /	.61
Special colors	lb.	.42 /	.45
Tenite Acetate, Group 1	lb.	.50 /	.59
Group 2	lb.	.46 /	.55
Group 3	lb.	.41 /	.51
Group 4	lb.	.38 /	.49
Group 5	lb.	.65 /	.75
Cellulose acetate butyrate:			
Tenite butyrate	lb.	.62 /	.71
A pearls	lb.	.72 /	.81
Blacks, reprocessed	lb.	.50 /	.58
Ethyl cellulose:			
Dyeform 720, 721	lb.	1.29 /	1.52
Ethocel P. G.	lb.	.72 /	.80
Bulk, reg.	lb.	.66 /	.81
Std., 7 cps.	lb.	.71 /	.86
Hercocel E	lb.	.72 /	.88

Epoxy

Araldite 502, 6010, 6020	lb.	.80 /	.995
504	lb.	.77 /	.965
551, 6060	lb.	.75 /	.95
6030, 6040	lb.	.885 /	.995
Bakelite ERL series	lb.	.80 /	.995
Epocast 2, 3, 5	lb.	1.33 /	1.77
4-B-2, 4-B, 4-C, 4-C-T, 4-D, Paste	lb.	1.15 /	1.55
Epon 562	lb.	1.52 /	1.77
815	lb.	.80 /	.99
820, 828	lb.	.80 /	.97
834	lb.	.855 /	1.00
864	lb.	.91 /	1.06
864-C-75	lb.	.73 /	.85
1001	lb.	.615 /	.85
1004	lb.	.595 /	.6025
1007	lb.	.605 /	.6125
1009	lb.	.69 /	.6975
Furane CN-502	lb.	1.33 /	1.77
Jet-Kote (with cat.)	gal.	7.50 /	10.00
Rezolins A & B	lb.	1.29 /	1.74
Toolplastik packages:			
L-900, L-930	lb.	1.59 /	2.29
L-902	lb.	1.69 /	1.84
L-904	lb.	1.54 /	2.19
L-910	lb.	1.94 /	2.34
L-914	lb.	1.83 /	2.19
L-931	lb.	1.75 /	1.99
L-940	lb.	2.05 /	2.29

Fluorocarbon

Bakelite FGBB-33789, FGEB-34790, FXMA-50590, FXMB-50344	lb.	9.00 /	10.00
FGEB-32788, FXMB-50090	lb.	12.00 /	14.00
FYTD	lb.	11.00 /	13.00
FYTH, FYTS	lb.	8.50 /	9.50
Kel-F Grade 270, 300			
High density	lb.	9.00 /	10.00
Low density	lb.	8.50 /	9.50
Grade 300-P25	lb.	10.00 /	11.00
Polyfluoron, high density crystals & pellets	lb.	9.00 /	9.50
Colors	lb.	9.50 /	10.00
Low density powder	lb.	8.50 /	9.00
Dispersion grade	lb.	10.50 /	11.00
Teflon powder, dispersion	lb.	7.00 /	7.75
Fine	lb.	9.50 /	11.00
General	lb.	5.10 /	5.75
Tape cylinder	lb.	5.35 /	6.00

Melamines

Fiberite 2015 (black & pastels)	lb.	.57 /	.62
Pelleted	lb.	.61 /	.66
Cymel 402	lb.	.51 /	.53
404R, 404T	lb.	.85 /	.95
405	lb.	.45 /	.52
428	lb.	.48 /	.55
430	lb.	.465 /	.535
440	lb.	1.10	
480	lb.	.265 /	.315
1077, 1079	lb.	.45 /	.75
Ungranulated	lb.	.43 /	.73
1500	lb.	.42 /	.55
1502	lb.	.45 /	.58
3020	lb.	.57 /	.72
3024-A	lb.	.67	
3135	lb.	.85 /	1.05
3136	lb.	1.05 /	1.15
P-592, -592-A	lb.	.65 /	.75
Plaskon	lb.	.44 /	.75

Phenolic

91-LD	lb.	1.50 /	2.50
Admirez PL-50	lb.	.215	
UP-11	lb.	.2325	
Bakelite general purpose	lb.	.187 /	.3525
BMG-5000	lb.	.19 /	.30
Colors	lb.	.2375/	.435
Chem. resist.	lb.	.23 /	.40
Electrical Insul.	lb.	.2725/	.4125
Heat resist.	lb.	.19 /	.35
Impact resist.	lb.	.24 /	.4025
Barrett foundry resins, liquid	lb.	.2125/	.2425
Powdered	lb.	.27 /	.355
Insulation resins	lb.	.15 /	.175
Molding resin 313, 314, 317	lb.	.27 /	.285
316	lb.	.295 /	.31
1502, -3, -4, -5, R-110R	lb.	.25 /	.265
R-114	lb.	.285 /	.30
Corfoam 107, 114	lb.	.55 /	.82
Cyacor 151	lb.	.215 /	.235
191	lb.	.13 /	.16
Durez, heat resist.	lb.	.19 /	.245
Impact resist.	lb.	.24 /	.63
Insulation	lb.	.21 /	.305
Non-Bleed	lb.	.19 /	.195
Special	lb.	.19 /	.665
Std.	lb.	.19 /	.245
Durite GP	lb.	.195 /	.24
HR	lb.	.191 /	.3025
IM	lb.	.24 /	.415
SG	lb.	.195 /	.3575
Dyform	lb.	1.10 /	1.35
Fiberite 1078	lb.	.42 /	.43
1087, 1165, 1270, 1271, 1330, 1332, 1347, FM 1132, FM 3510	lb.	.39 /	.395
1153	lb.	.455 /	.46
1167	lb.	.3875/	.3925
1340	lb.	.4275/	.43
1346	lb.	.44 /	.45
4010	lb.	.68	
4020	lb.	.815 /	.82
FM 926	lb.	.43 /	.435
927	lb.	.41 /	.42
1914	lb.	.375 /	.38
1957	lb.	.445 /	.45
1996	lb.	.375 /	.38
10365	lb.	.5225/	.53
11547	lb.	1.05 /	1.06
11678	lb.	.52 /	.53
14111	lb.	.415 /	.42
17067	lb.	.851 /	.86
17610	lb.	1.05 /	1.06
Fiberite 1078	lb.	.425 /	.43
1087, 1165, 1270, 1271, 1330, 1332, 1347, 1389, FM-1132, FM-3510, FM-3515	lb.	.395 /	.40
1153 (red only)	lb.	.46 /	.465
1167	lb.	.3925/	.397
1333, FM-10365, FM-11678	lb.	.67 /	.675
1346, FM-927	lb.	.415 /	.42
1346 (red only)	lb.	.445 /	.45
4030-190	lb.	.78 /	.81
4031	lb.	.625 /	.63
FM-926	lb.	.435 /	.44
FM-1132 (pellets), FM-14111	lb.	.42 /	.425
FM-1914, FM-1996	lb.	.38 /	.385
FM-11547, FM-17610	lb.	1.07 /	1.08
FM-11679	lb.	1.29 /	1.30
FM-17067	lb.	.83 /	.835
G-E 12368, 12374, 12392 shell molding resins	lb.	.26 /	.33
12401	lb.	.2975	
12408, 12460, 12486, 12490, 12491, 12493, 12853, 12875, 12883, 12885, 12886, 12900, 12901	lb.	.195 /	.20
12410, 12420	lb.	1.50	
12432	lb.	.395	
12433	lb.	.555	
12435	lb.	.24	
12439, 12456	lb.	.265	
12444	lb.	.425	
12462	lb.	.505	
12463	lb.	.405	
12467	lb.	.51	
12487, 12489, 12884, 12887	lb.	.355	
12494	lb.	.375	
12495	lb.	.245	
12808	lb.	.49	
12809	lb.	.65	
12817, 12882	lb.	.205 /	.21
12841	lb.	.2425	
Loven LHR-401, -403	lb.	.225 /	.23
-407, -409	lb.	.60 /	1.00
-408	lb.	.25 /	.255
LI-201	lb.	.39 /	.40
-207	lb.	.475 /	.48
-209	lb.	.60 /	1.00
-212	lb.	.425 /	.43
LM-110, -119	lb.	.19 /	.195
-101	lb.	.24 /	.245
-116	lb.	.255 /	.26
-117	lb.	.225 /	.23
-118	lb.	.1975/	.2025
LMI-301	lb.	.2525/	.2575
-303	lb.	.345 /	.35
-304	lb.	.60 /	1.00
-307	lb.	.3075/	.3125
LMM-801, -803	lb.	.2125/	.2175
-804, -811	lb.	.245 /	.25
-807	lb.	.215 /	.22
Marblette casting resins	lb.	.50 /	.60
Plenco foundry resins	lb.	.27 /	.35
Molding cmpds. gen. purpose	lb.	.185 /	.235
Heat resist.	lb.	.19 /	.24
Improved impact	lb.	.225 /	.25
Min. bleed	lb.	.185 /	.195
Radio & TV	lb.	.20 /	.215
Stock	lb.	.205 /	.34
R-72S casting resin	lb.	.46 /	.74
Reilly general purpose	lb.	.195 /	.20
Heat & impact resist.	lb.	.20 /	.205
Resinox, gen. purpose, heat resist.	lb.	.19 /	.20
Impact	lb.	.245 /	.312
Low elec. loss	lb.	.30 /	.355
Special	lb.	.20 /	.24
Rogers RX-425	lb.	.285 /	.35
-428	lb.	.345 /	.42
-429	lb.	.355 /	.425
-431	lb.	.4125/	.495
-438	lb.	.4575/	.4625
-442	lb.	.3375/	.3425
-447	lb.	.495 /	.50
-448	lb.	.345 /	.35
-458	lb.	.37 /	.375
-469	lb.	.355 /	.36
-525	lb.	.285 /	.29
-530	lb.	.4125/	.4175
-625	lb.	.385 /	.39
Schenectady shell mold resins	lb.	.26 /	.28
Synvar molding compounds:			
PM-6443, -6444, -6446, -6447, -6449, -6494, -6512, 6516, 6593, -6594, -6596, -6598, -6599, -56502, -56512	lb.	.19 /	.205
PM-76925	lb.	.205	.215
PM-86446, -86516	lb.	.2425	.2525
PM-86513	lb.	.245 /	.255
PM-86517	lb.	.37 /	.38

Synvaren 640	lb.	.245 /	.28
920	lb.	.21 /	.255
935	lb.	.185 /	.21
9203	lb.	.168 /	.203
Synvaren liquid industrial resins:			
615	lb.	.2425/	.2775
673X	lb.	.25 /	.275
675	lb.	.285 /	.32
917	lb.	.27 /	.295
920	lb.	.21 /	.255
924	lb.	.385 /	.42
38100	lb.	.31 /	.345
CP-66	lb.	.185 /	.22
PBL-2	lb.	.32 /	.355
PBL-218S, -919	lb.	.265 /	.30
PBL-911-I	lb.	.30 /	.325
Synvarite GW-1000, PBL-410, P-14Y, PNL-12 PD	lb.	.32 /	.34
GW-1080, PBL-108F, PBL-718	lb.	.36 /	.38
GW-1330	lb.	.45 /	.47
GW-1600, PBL-108FF	lb.	.37 /	.39
GW-2400	lb.	.365 /	.385
GW-7311	lb.	.535 /	.555
PBL-100	lb.	.30 /	.32
PBL-210, PBL-3301	lb.	.35 /	.37
PBL-218, PNL-12H, RC-420	lb.	.33 /	.35
PBL-731	lb.	.425 /	.445
PBL-3311, PNL-161 PD	lb.	.34 /	.36
PNL-12, PNL-355H	lb.	.315 /	.335
PNL-12HL, PNL-156HL	lb.	.2925/	.3125
PNL-156	lb.	.335 /	.355
PNL-156H	lb.	.345 /	.365
PNL-160H/2	lb.	.31 /	.33
PNL-161H	lb.	.35 /	.37
PNL-169H, -169HL	lb.	.28 /	.30
PNL-169 PD	lb.	.27 /	.29
PNL-355 PD	lb.	.305 /	.325
PNL-355HF	lb.	.325 /	.345
PNL-1277HL, -1278HL, -1279HL	lb.	.2775/	.2975
POS-50	lb.	.40 /	.42
POS-56	lb.	.41 /	.43
PT	lb.	.295 /	.305
RC-244	lb.	.385 /	.405
Toolplastik No. 8000	lb.	.48 /	.72

Polyamide

G.M.I. Polyamide 115	lb.	.64 /	.77
Versamid 115	lb.	.66 /	.89
Zytel molding powder	lb.	1.435 /	1.60

Polyesters

Acme 1-501	lb.	.82 /	.93
1-501A	lb.	.87 /	.98
1-503	lb.	2.75 /	3.50
1-510	lb.	.89 /	1.00
Atlac 363E-02Z, -12Z	lb.	.66 /	.69
-32Z	lb.	.68 /	.71
382E	lb.	.57 /	.60
FP	lb.	.66 /	.69
Bakelite Polyester resins	lb.	.35 /	.75
Celanese polyesters:			
CEL-101, Marcothix 1, 3	lb.	.50 /	.565
Marcothix 5, 7, 8	lb.	.46 /	.525
MR-28C, -28V, -37C, -37CX	lb.	.33 /	.395
MR-28CS	lb.	.35 /	.415
MR-28H, -41R	lb.	.36 /	.425
MR-28R, -36R	lb.	.34 /	.405
MR-28RL, -37RL	lb.	.355 /	.42
MR-30C	lb.	.44 /	.505
MR-31C, -31V	lb.	.37 /	.435
MR-33C	lb.	.53 /	.595
MR-40R	lb.	.38 /	.445
Diall 50-01	lb.	2.90 /	3.00
50-51	lb.	3.25 /	3.50
50-52	lb.	3.50	
51-01	lb.	.87 /	.98
52-01	lb.	2.25 /	2.50
52-20-30	lb.	1.50	
Diall 50-01, 50-51, 50-52	lb.	2.75 /	3.50
51-01	lb.	.87 /	.98
52-01	lb.	1.95 /	2.50
52-20-30	lb.	1.30 /	1.50
Fibercore 1000, 2000	lb.	.50 /	.65
3000	lb.	.55 /	.70
G-E polyesters			
AR 401	lb.	.35 /	.365
AR 403, 480	lb.	.34 /	.355
AR 403 LS, 480 LS	lb.	.355 /	.37
AR 493	lb.	.40 /	.415
AR 499	lb.	.435 /	.45
AR 501	lb.	.455 /	.47
Hetron	lb.	.43 /	.485
IC-312, -400, -514, -548, -625, -730, -800	lb.	.35 /	.385
-312-2	lb.	.365 /	.38
-336, -382, -706	lb.	.37 /	.385
-401	lb.	.44 /	.455
-420	lb.	.355 /	.37
-433	lb.	.38 /	.395
-636, -670	lb.	.48 /	.495
-638, -689	lb.	.55 /	.565
-670-2	lb.	.50 /	.515
-671	lb.	.405 /	.42
Filled resins	lb.	.255 /	.54
Laminac 4110	lb.	.33 /	.345
4111	lb.	.45 /	.465
4116	lb.	.33 /	.345
4120	lb.	.39 /	.405
4123, 4128	lb.	.34 /	.355
4134	lb.	.46 /	.475
4146	lb.	.43 /	.445
4192	lb.	.355 /	.37
4202	lb.	.55 /	.565
Mylar, rolls, types A & C	lb.	2.50 /	4.80
Type D	lb.	3.00 /	3.30
Sheets, type A	M. sq. in.	.09 /	1.11
Type C	M. sq. in.	.09 /	.15
Type D	M. sq. in.	.53 /	1.34
Plaskon 911, 920	lb.	.55 /	.665
941, 942, 951, 9411	lb.	.35 /	.465
943	lb.	.41 /	.525
9404	lb.	.365 /	.48
9406	lb.	.355 /	.465
9500, 9510, 9511	lb.	.35 /	.465
9600	lb.	.44 /	.555
Polycast 2	sq. ft.	1.89 /	5.18
3	sq. ft.	1.08 /	18.00
6	sq. ft.	.66 /	3.10
7	sq. ft.	.72 /	7.18
CR-39	sq. ft.	1.25 /	20.00
Pre-Imp	lb.	.68 /	.85
Thermaflow 100, 200, 300	lb.	.48 /	.82
400, 500	lb.	.52 /	.87
1,000, 2,300	lb.	.34 /	.55
2,400	lb.	.36 /	.58
Vibrin 114, 117, 152, 154	lb.	.34	
115A	lb.	.38	
121	lb.	.46	
135	lb.	3.00	
142	lb.	.50	
151	lb.	.35	
152LS-4	lb.	.355	
153	lb.	.40	
X-1633-A	lb.	.49	
X-1636-W	lb.	.585	

Polyethylene

A-C No. 6, 617	lb.	.30 /	.37
No. 6A, 7, 617A	lb.	.35 /	.42
No. 615, G-201	lb.	.38 /	.45
No. 629	lb.	.40 /	.47
No. 729	lb.	.45 /	.52
Alathon	lb.	.41 /	.505
Bakelite DE Series	lb.	.43 /	.725
DYGT	lb.	.54 /	.69
DYLT, DYNF, DYNH	lb.	.41 /	.59
DYNJ	lb.	.44 /	.62
DYNK	lb.	.45 /	.63
Catalin 15-5	lb.	.41 /	.59
Celanese polyethylene sheeting:			
Extruded rolls, 44 in. wide	lb.	.56 /	1.12
Sheets, 44 x 60 in.	sheet	.83 /	8.76
Petrothene 100, 110, 200, 201, 202, 203, 210, 211, 213, 301, 312, 322	lb.	.41 /	.51
310, 320	lb.	.45 /	.55
310-BK-3, 320-BK-3, 320-BK-½, 320 colors	lb.	.53 /	.63
311, 321	lb.	.43 /	.53
311-BK-3, 312-BK-3, 322-BK-3 322-BN-1	lb	.375 /	.48
311-BK-½, 321-BK-3, 321-BK-½, 321-BN-1	lb.	.46 /	.56
321 colors	lb.	.50 /	.60
560	lb.	.38 /	.48
Poly-Eth 1003	lb.	.45 /	.59
1004, 1005, 1007, 1008.5, 2005, 2007, 2037, 2205, 2215, 2235	lb.	.41 /	.55
3215	lb.	.35 /	.515
4005	lb.	.43 /	.57
5003	lb.	.53 /	.68
5005	lb.	.375 /	.515
Reynolon 1000, P series	lb.	.60 /	.80
Tenite Group 1	lb.	.41 /	.45
Group 2	lb.	.43 /	.47
Group 3	lb.	.46 /	.50
Group 4	lb.	.39 /	.43
Group 5, 6	lb.	.50 /	.72
Group 7	lb.	.60 /	.82
Group 8	lb.	.70 /	.92

Silicone

Bakelite GMGA-5001, -5002	lb.	2.75 /	3.10
5003	lb.	4.00 /	4.35
5004	lb.	5.40 /	5.75

Styrenes

Ampacet, crystal	lb.	.315 /	.335
Colors, std.	lb.	.345 /	.365
Special	lb.	.345 /	.75
Pearl	lb.	.41 /	.75
Phosphorescent	lb.	.695 /	1.00
Tinsel	lb.	.41 /	.67
Confetti	lb.	.51 /	.70
Bakelite BMC series, nat.	lb.	.45 /	.685
Colors	lb.	.50 /	.735
BMS, SMD series, crystal	lb.	.295 /	.31
Colors, std.	lb.	.335 /	.35
Special	lb.	.335 /	.52
RMD series, nat.	lb.	.45 /	.685
Colors	lb.	.50 /	.735
TGD series	lb.	.33 /	.35
Colors, std.	lb.	.36 /	.38
Special	lb.	.36 /	1.00
TMD series	lb.	.33 /	.40
Colors, std.	lb.	.36 /	.43
Special	lb.	.36 /	1.00
Catalin, high impact, natural	lb.	.325 /	.355
Colors, std.	lb.	.355 /	.385
Special	lb.	.36 /	1.00
Medium impact, natural	lb.	.325 /	.355
Colors, std.	lb.	.355 /	.385
Special	lb.	.355 /	1.00
Regular grade, crystal	lb.	.305 /	.325
Colors, std.	lb.	.345 /	.365
Special	lb.	.345 /	1.00
Utility black	lb.	.18 /	.235
Cycolac 12769 A, 12877, 12968, 12982	lb.	.73 /	.81
12803	lb.	.65 /	.73
12830, 12967	lb.	.70 /	.78
12876 A	lb.	.69 /	.77
12981	lb.	.78 /	.86
12983	lb.	.76 /	.84
12984	lb.	.77 /	.85
13022	lb.	.72 /	.80
Natural Powder	lb.	.58 /	.66
Pellets nat. & std. colors	lb.	.65 /	.73
Darex Copolymer 3	lb.	.47 /	.67
43G	lb.	.39 /	.58
X34	lb.	.42 /	.61
Latices 3L	lb.	.415 /	.56
610L	lb.	.30 /	.46
3020	lb.	.32 /	.47
Dow Latex, polystyrene	lb.	.30 /	.46
Latices, styrene/butadiene	lb.	.25 /	.35
Resins PS-2&3	lb.	.30 /	.46
Dylite, expandable beads	lb.	.50 /	.60
Koppers, Fibertuff	lb.	.55 /	1.505
MC-185 series	lb.	.33 /	.355
-300 series	lb.	.33 /	1.005
-400 series	lb.	.355 /	1.005
Regular, crystal	lb.	.295 /	.315
Colors, std.	lb.	.335 /	.355
Special	lb.	.335 /	1.005
Pearl	lb.	.41 /	1.005
Phosphorescent	lb.	.695 /	2.005
Kralastic, std. colors	lb.	.50 /	1.10
Lustrex Hi-Flow 55, crystals	lb.	.295 /	.31
Hi-Test 88, std.	lb.	.36 /	.38
Special colors	lb.	.36 /	1.00
L, crystals	lb.	.295 /	.31
Colors, std.	lb.	.335 /	.35
Special	lb.	.335 /	1.00
LHA, std.	lb.	.355 /	.375
Special	lb.	.355 /	1.00
Utility black, gen. purpose	lb.	.18 /	.185
High impact	lb.	.235 /	.24
Medium impact	lb.	.19 /	.195
Marbon resins	lb.	.39 /	.46
Plio-Tuf C75	lb.	.37 /	.40
G85	lb.	.52 /	.54
Polycast 4	sq. ft.	2.56 /	11.07
Styron 475, natural	lb.	.33 /	.35
Colors, std.	lb.	.36 /	.38
Special	lb.	.36 /	1.00
Sheets, std.	lb.	.55 /	.60
Special	lb.	.55 /	.62
480, natural black	lb.	.38 /	.40
Colors, std.	lb.	.41 /	.43
Special	lb.	.41 /	1.00
647, crystal	lb.	.305 /	.32
Colors, special	lb.	.345 /	1.34
66, 688, crystal	lb.	.295 /	.31
Colors, std.	lb.	.335 /	.35
Special	lb.	.335 /	1.00
700, crystal	lb.	.295 /	.31
Colors, std.	lb.	.335 /	.35
Special	lb.	.335 /	1.00
777 colors, std.	lb.	.355 /	.375
Special	lb.	.355 /	1.00

Urea

Admirez Foundry Resins, SP-30	lb.	.27	
UP-50	lb.	.105	
Beetle C-4980 Brown	lb.	.1875/	.30
No fines granulation	lb.	.2075/	.32
T-298 Black	lb.	.1875/	.30
MUP series, powder	lb.	.30 /	.49
Special colors	lb.	.30 /	.59
Granules	lb.	.33 /	.52
Special colors	lb.	.33 /	.62
Plaskon molding cmpds.:			
Black & Brown	lb.	.1875/	.30
Other colors	lb.	.30 /	.62
Foundry resins, liquid	lb.	.10 /	.13
Powdered	lb.	.2325/	.2525
Sylplast molding cmpds., granules	lb.	.33	
Powder	lb.	.30	

Vinyls

Bakelite QG-5909	lb.	.35 /	.585
QG-5921	lb.	.41 /	.645
5924	lb.	.43 /	.665
QYNA, QYSM, QYSQ	lb.	.27 /	.47
QYNV	lb.	.30 /	.50
QYSJ	lb.	.28 /	.48
VG-1914, 1918	lb.	.37 /	.056
1985	lb.	.35 /	.585
5507	lb.	.31 /	.545
5544	lb.	.405 /	.64
5911	lb.	.315 /	.55
5980	lb.	.32 /	.555
7734	lb.	.28 /	.515
9031	lb.	.265 /	.50
9530	lb.	.275 /	.51
9960, 9970, 9980	lb.	.335 /	.57
VAGH	lb.	.55 /	.75
VMCH	lb.	.41 /	.61
VYDR, VYNW	lb.	.27 /	.47

VYHH	lb.	.32 /	.52
VYLF	lb.	.36 /	.56
VYNS	lb.	.44 /	.64
VYNV	lb.	.32 /	.52
Blacar No. BW-60	lb.	.315 /	.385
NEMA colors	lb.	.355 /	.425
No. BW-80	lb.	.405 /	.455
NEMA colors	lb.	.445 /	.495
No. PC white, ivory, black	lb.	.285 /	.335
Other colors	lb.	.325 /	.375
Darex Everplex A (wet wt.)	lb.	.21 /	.39
B (wet wt.)	lb.	.22 /	.40
G (wet wt.)	lb.	.21 /	.39
Copolymer Y (wet wt.)	lb.	.245 /	.28
PVA Emulsions (wet wt.)	lb.	.19 /	.355
Diamond PVC-45, -50	lb.	.38 /	.44
Dow PVC-100, -111	lb.	.38 /	.57
Exon 402A, 500, 905, 915, 925	lb.	.31 /	.51
450, 468R, 480	lb.	.35 /	.55
461	lb.	9.75	
468	lb.	.33 /	.53
470	lb.	.55	
471	lb.	.50	
654	lb.	.34 /	.54
Formvar	lb.	.865 /	1.03
Gelva emulsions	lb.	.19 /	.205
Granules	lb.	.4175/	.6175
Geon 101, 101EP, 103EP, 202	lb.	.27 /	.45
121	lb.	.30 /	.48
126	lb.	.28 /	.46
400X110	lb.	.41 /	.59
404HI	lb.	.37 /	.55
409, 426, 427, 428	lb.	.32 /	.50
503H (polyblend)	lb.	.425 /	.525
2042, 2046	lb.	.315 /	.55
Colors	lb.	.365 /	.60
6373	lb.	.345 /	.58
Colors	lb.	.395 /	.63
6461	lb.	.325 /	.56
Colors	lb.	.375 /	.61
8372	lb.	.33 /	.565
Colors	lb.	.38 /	.615
8539, 8726	lb.	.33 /	.565
Colors	lb.	.35 /	.585
8590, 8591, 8592, 8593, 8594, 8595	lb.	2.00 /	2.75
8600	lb.	.275 /	.51
Colors	lb.	.325 /	.56
8620	lb.	.27 /	.505
Colors	lb.	.32 /	.555
8630	lb.	.425 /	.66
Colors	lb.	.475 /	.71
8640	lb.	.35 /	.585
8650	lb.	.32 /	.555
8677	lb.	.435 /	.67
8700A, 8750	lb.	.425 /	.66
Colors	lb.	.455 /	.69
8720	lb.	.605 /	.84
8737	lb.	.33 /	.565
8740	lb.	.295 /	.53
8749	lb.	.29 /	.525
8800	lb.	.44 /	.675
8801	lb.	.275 /	.51
Colors	lb.	.325 /	.56
8802	lb.	.33 /	.565
Colors	lb.	.38 /	.615
8804	lb.	.29 /	.525
8807	lb.	.45 /	.685
8809	lb.	.37 /	.605
8810	lb.	.275 /	.55
8812, 8813, 8814, 8815	lb.	.315 /	.51
Geon Latex 151, 251	lb.	.26 /	.32
351	lb.	.32 /	.38
352	lb.	.28 /	.34
552, 652	lb.	.37 /	.43
450x167	lb.	.39 /	.45
576	lb.	.365 /	.405
Krene, film	lb.	.505 /	.655
Sheeting	lb.	.49 /	.645
Marvinols:			
NF-1005	lb.	.34 /	.625
NF-1055, 3520	lb.	.275 /	.56
NF-3020	lb.	.41 /	.645
NF-3025	lb.	.38 /	.665
NF-3040	lb.	.3375/	.6225
NF-3045, 3050	lb.	.37 /	.605
NF-3055	lb.	.285 /	.57
NF-3060	lb.	.29 /	.575
NF-3065	lb.	.30 /	.585
NF-3070, 3075, 3080		.265 /	.50
NF-3085, 3090, 3095	lb.	.29 /	.525
NF-3505, 3515	lb.	.36 /	.595
NF-3510	lb.	.34 /	.575
NF-4005	lb.	.44 /	.675
NF-4010, 4015, 4020	lb.	.42 /	.705
NF-5015, 5020	lb.	.40 /	.655
NF-5025	lb.	.33 /	.585
NF-5030	lb.	.29 /	.545
NR-6015	lb.	.39 /	.685
NR-6020	lb.	.39 /	.675
NR-7002, 7045, 7060	lb.	.50 /	.735
VR-10	lb.	.30 /	.47
VR-12, -20, -21, -22, -24, -30	lb.	.29 /	.46
VR-50	lb.	.32 /	.49
Opalon 300, 300FM	lb.	.31 /	.51
410	lb.	.34 /	.54
505	lb.	.35 /	.55
Inj. molding cmpds.	lb.	.29 /	.67
Profile extrusion cmpds.	lb.	.29 /	.72
Wire cmpds.	lb.	.29 /	.67
Plastiflex, std.	lb.	.90 /	1.10
Novelty	lb.	1.15 /	1.50
Pliovic AO (dispersion)	lb.	.30 /	.32
DB80V, DB90V, EDB90V	lb.	.27 /	.29
Latex 300	lb.	.30 /	.35
Reynolon, 4000 series	lb.	1.55 /	2.30
Rolls, 1-mil	sq. yd.	.0625/	.11
Colors	sq. yd.	.0675/	.08
4-mil	sq. yd.	.215 /	.3125
Colors	sq. yd.	.2375/	.255
16-mil	sq. yd.	.81 /	1.19
Colors	sq. yd.	.86 /	.945
Satinflex	lb.	1.15 /	1.50
Vygen 110, 120	lb.	.27 /	.31
1101, 1150	lb.	.425 /	.50
2201	lb.	.48 /	.55

Vinylidine

Dow Latex 744-B	lb.	.26 /	.42
Resin 565	lb.	.39 /	.525
Saran formulation 115, black, nat.	lb.	.39 /	.52
Colors	lb.	.44 /	.69
720 nat.	lb.	.41 /	.54
Colors	lb.	.46 /	.71
747 nat.	lb.	.395 /	.525
761 nat.	lb.	.39 /	.52
Colors	lb.	.44 /	.69
820 nat.	lb.	.42 /	.55
Colors	lb.	.47 /	.60
Latices	lb.	.45 /	.61
Resin F 120	lb.	.58 /	.65
F242	lb.	.64 /	.70

Solvents

Enjay acetone	lb.	.08 /	.115
Isopropyl acetate	lb.	.105 /	.14
Methylethyl ketone	lb.	.115 /	.15
Secondary butyl acetate	lb.	.1125/	.1475
Butyl alcohol	lb.	.115 /	.15
Petrohol 91%	gal.	.37 /	.60
95%	gal.	.39 /	.62
99%	gal.	.41 /	.64

Stabilizers

Advastab B-13-P, BC-105, XBC-147	lb.	.75 /	.80
BC-12, C-77, E-82, XC-79, XC-143	lb.	.90 /	.95
BC-74, XBC-30	lb.	.70 /	.75
C-21	lb.	1.00 /	1.05
CH-20, CH-49	lb.	.60 /	.65
JCX	lb.	.62 /	.67
L paste, Z-6	lb.	.65 /	.70
SN	lb.	.47 /	.52
T-10, T-52	lb.	1.90 /	1.95
T-17M	lb.	2.95 /	3.00
T-50LT, T-72	lb.	3.20 /	3.25
T-671	lb.	2.65 /	2.70
XE-98	lb.	.53 /	.58
Argus Mark C	lb.	.88 /	.95
E	lb.	.72 /	.85
M	lb.	.68 /	.74
PL	lb.	.63 /	.69
TT	lb.	.72 /	.86
WS	lb.	.98 /	1.11
X	lb.	2.50 /	2.75
XI	lb.	.87 /	1.01
XV	lb.	.92 /	.99
XX	lb.	.58 /	.65
Barca 10	lb.	.75 /	.80
Baker barium ricinoleate	lb.	.70	
Calcium ricinoleate	lb.	.55	
Zinc vicinoleate	lb.	.60	
Dutch Boy Barinac	lb.	.70	
Calstar	lb.	.37	
Clarite A	lb.	.83	
B	lb.	.68	
CS-137	lb.	1.25	
DS-207	lb.	.55	
Dyphos	lb.	.58 /	.595
50A	lb.	.34	
Dythal	lb.	.395 /	.41
Leadstar	lb.	.39	
Lectro 60	lb.	.2525	
Normal lead maleate	lb.	.4475	
Normasal	lb.	.46	
Pearlescent pigment	lb.	1.00	
Plumb-O-Sil-A	lb.	.3075	
-B	lb.	.325 /	.37
-C	lb.	.3475/	.375
Provinite A	lb.	.83	
B	lb.	.68	
Tribase	lb.	.275	
-E	lb.	.2225	
Trimal	lb.	.435	
Ferro 182	lb.	.70 /	.76
200	lb.	1.31 /	1.43
203, 900, 1820	lb.	.88 /	1.00
503	lb.	.28 /	.40
541A	lb.	.80 /	.92
700	lb.	.47 /	.59
703, 1972	lb.	.63 /	.75
823	lb.	2.50 /	2.75
840	lb.	3.25	
903	lb.	.58 /	.70
909	lb.	.91 /	1.01
1203	lb.	1.30 /	1.40
1206	lb.	1.23 /	1.33
1212	lb.	.68 /	.80
1825	lb.	.98 /	1.10
1840	lb.	.73 /	.85
Harshaw 1-V-3	lb.	.43	
1-V-4	lb.	.68	
1-V-7	lb.	.66 /	.71
2-V-4	lb.	.85 /	.90
2-V-7	lb.	1.10 /	1.15
2-V-8	lb.	1.30	
2-V-400	lb.	.80 /	.85
5-V-1	lb.	.41	
5-V-22	lb.	.49	
7-V-1	lb.	.90 /	.95
7-V-2	lb.	.95 /	1.00
7-V-4	lb.	1.18 /	1.23
8-V-1	lb.	1.10 /	1.15
8-V-5	lb.	.80 /	.85
8-V-100	lb.	.84 /	.89
9-V-1	lb.	.76 /	.81
12-V-5	lb.	.75	
22-V-1	lb.	1.28	
24-V-1	lb.	1.28 /	1.33
28-V-2	lb.	1.18	
128-V-5	lb.	.86	
281-V-4	lb.	.90	
Merix AST Concentrate 1001	lb.	.355 /	1.75
Metasap 613-A	lb.	.69	
613-B	lb.	.84	
613-C	lb.	1.06	
621	lb.	.88	
624	lb.	.75	
Cadmium stearate	lb.	1.40 /	1.44
Fused stearates, calcium 602-A	lb.	.25 /	.30
Dibasic lead stearate	lb.	.56	
Lead 611	lb.	.32 /	.37
Lead stearate	lb.	.39 /	.44
Nuostable V-1	lb.	.54 /	.59
V-2	lb.	.39 /	.44
V-10	lb.	.70 /	.75
V-20	lb.	1.30 /	1.35
V-21	lb.	1.29 /	1.34
V-30	lb.	.90 /	.95
V-31	lb.	.80 /	.85
V-40	lb.	1.18 /	1.23
V-42	lb.	.65 /	.70
V-43	lb.	.75 /	.80
V-44	lb.	.90 /	.95
V-45	lb.	1.10 /	1.15
V-50	lb.	.49 /	.54
V-60	lb.	.37 /	.42
V-70	lb.	.68 /	.73
V-80	lb.	2.80 /	2.85
V-81	lb.	2.90 /	2.95
Permyl A	lb.	.45 /	.57
Stabelan 110, 120	lb.	.65 /	.75
115, HR paste	lb.	.85 /	.95
E	lb.	1.35 /	1.50
HR-50	lb.	.75 /	.90
HR liquid	lb.	.65 /	.75
Powder	lb.	.95 /	1.05
XL	lb.	.55 /	.65
Stabilizer #3, 52	lb.	1.90 /	2.00
17-M	lb.	3.00 /	3.25
#42	lb.	.83 /	.93
89-X	lb.	.75 /	.80
#143	lb.	.80 /	.90
A-5	lb.	1.25	
BC-12	lb.	.87 /	.95
BC-105	lb.	.75 /	.85
C-2	lb.	1.65	
C-77	lb.	.85 /	.95
CH-14	lb.	.63 /	.70
CH-20	lb.	.63 /	.65
D-22	lb.	1.99 /	2.05
E-6-B	lb.	.80 /	.90
E-49	lb.	.60 /	.65
E-98	lb.	.55 /	.65
JCX	lb.	.62 /	.68
L-Paste	lb.	.60 /	.65
Mark E	lb.	.72 /	.85
M	lb.	.73 /	.83
PL	lb.	.74 /	.84
TT	lb.	.77 /	.91
V	lb.	.91 /	1.04
X	lb.	2.50 /	2.75
XI	lb.	.87 /	1.01
XV	lb.	.92 /	1.01
XX	lb.	.63 /	.74
OM-10	lb.	1.90 /	2.00
-18	lb.	3.10 /	3.35
P-1835	lb.	3.20 /	3.35
PS-38	lb.	.50 /	.65
SN	lb.	.47 /	.53
T-72	lb.	3.20 /	3.35
V-I-N	lb.	.49 /	.59
VL-3	lb.	.95 /	1.05
Staflex QMXA	lb.	.70	
50% in DOP	lb.	.52	
QY	lb.	1.00 /	1.20
Stayrite #10	lb.	.33 /	.37
#15	lb.	.54 /	.57
#20	lb.	.38 /	.42
#22	lb.	1.32 /	1.34
#25	lb.	.36 /	.49
#70, 75, 80, 90	lb.	.69 /	.70
#229	lb.	.47 /	.50
P-10	lb.	.40 /	.44
Thermolite 12	lb.	2.00 /	2.35
13	lb.	3.10 /	3.35
15	lb.	4.13	
17	lb.	2.45 /	2.75
20	lb.	2.95 /	3.25
39	lb.	2.75 /	3.25
91	lb.	3.00	
Vanstay C, S	lb.	.63 /	.65
HT	lb.	.90 /	.92
L	lb.	.33 /	.35
R	lb.	.70 /	.72

Wetting Agents

Advawet X-212	lb.	.50 /	.55
Poly-lube No. 4	gt.	1.45 /	1.94